GENERAL COMPUTER PROGRAM FOR PROCESS DESIGN AND SIMULATION OF COMPLEX EVAPORATION PLANTS

A Thesis Submitted
In Partial Fulfilment of the Requirements
for the Degree of
**MASTER OF TECHNOLOGY**

by
SUDHIR M. JAIN

to the

DEPARTMENT OF CHEMICAL ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY KANPUR
**APRIL, 1977**

CHE-1977-M-JAI-GEN
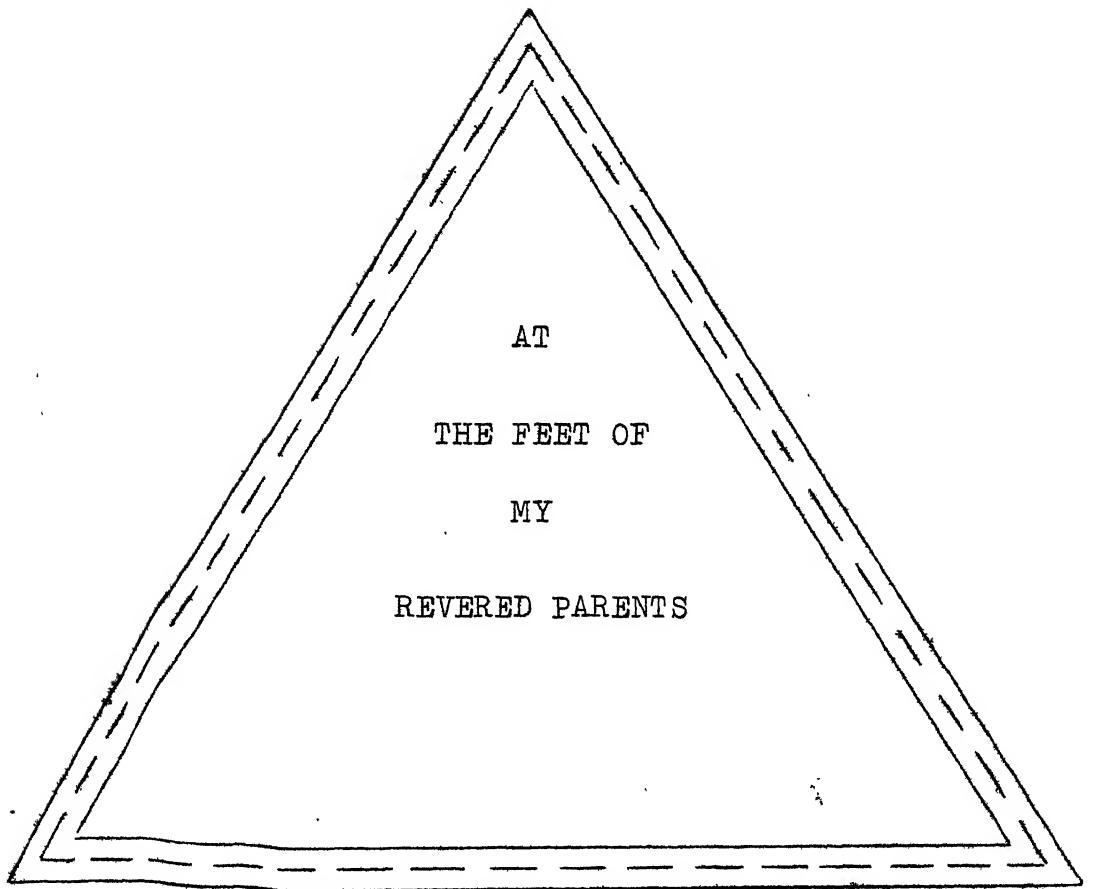
AT

THE FEET OF

MY

REVERED PARENTS
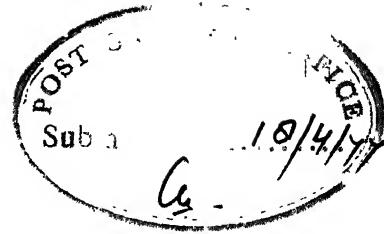
CERTIFICATE

This is to certify that this work 'GENERAL COMPUTER PROGRAM FOR PROCESS DESIGN AND SIMULATION OF COMPLEX EVAPORAT PLANTS' has been carried out under my supervision and has not been submitted elsewhere for a degree.

April 15. 1977

H. Veeramani, Ph.D.
Assistant Professor
Department of Chemical Eng
Indian Institute of Techno
Kanpur-208016

[ii]

ACKNOWLEDGEMENTS

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

A computer program 'MEEDS' for design and simulation calculations of a general multiple effect evaporation plant is developed in FORTRAN IV on IBM 7044 computer which can also be used on IBM-370. The program can handle process engineering calculations for a N-effect evaporation plant with different heat recovery features like liquor and condensate flash tanks and liquor preheaters, and also account for the effect of boiling point rise, radiation heat loss, finisher effect and vapor bleed streams. Process liquor can flow in forward, reverse, parallel or mixed pattern and also include two-tube pass arrangement in the first effect. The program can be used for design of a multiple effect evaporation plant for determining the steam consumption and heat transfer surface requirements. It can also be used for simulation studies to predict or evaluate plant performance based on observed data. A rigorous design analysis procedure is also developed for specifying the list of necessary input parameters for process calculations of any complex evaporation plant. The versatility of the program MEEDS is established by solving several design and simulation problems. These include evaporation plants of diverse complexities for systems like sugar solution, aluminate liquor, caustic lye, brine, black liquor and other process liquors. Execution time for MEEDS for the various problems considered is 1-15 s requiring 3-14 iterations for the desired convergence.

NOMENCLATURE

A	Heat transfer Area
AAV	AVerage Area
AFIN	Heat transfer Area of FINisher effect
AIH	Heat transfer Area of Integral Heater
BPR	Boiling Point Rise
BPRFIN	Boiling Point Rise in FINisher effect
BPRLFT	Boiling Point Rise in Liquor Flash Tank
C	Number of Components
CCFTO	Outgoing Condensate stream rate from Condensate Flash Tank
CFCFTO	Outgoing Condensate stream rate from Finisher Condensate Flash Tank
CFT	Condensate Flash Tank
C_p	Specific heat
DT	Temperature Difference potential
DTFIN	Temperature Difference potential in FINisher effect
DTIH	Temperature Difference potential in Integral Heater
FCFT	Finisher Condensate Flash Tank
FF	Feed Fraction rate through IFSORD array
FIN	FINisher effect
FPS	Total Feed rate through Parallel Streams (IFSORD array)
HC	Enthalpy of Condensate
HCCFTO	Enthalpy of Outgoing Condensate stream from Condensate Flash Tank

HCFFTO	Enthalpy of Outgoing Condensate stream from Finisher condensate Flash Tank
HE	Heat Exchanger
HLF	Enthalpy of Feed Liquor
HLFINO	Enthalpy of Outgoing Liquor from FINisher effect
HLI	Enthalpy of Incoming Liquor stream
HLLFTO	Enthalpy of Outgoing Liquor from Liquor Flash Tank
HLO	Enthalpy of Outgoing Liquor stream
HS	Enthalpy of Steam
HSFIN	Enthalpy of Steam to FINisher effect
HV	Enthalpy of Vapor
HVCFT	Enthalpy of Vapor stream from Condensate Flash Tank
HVFCFT	Enthalpy of Vapor stream from Finisher Condensate Flash Tank
HVFIN	Enthalpy of Vapor stream from FINisher effect
HVLFT	Enthalpy of Vapor stream from Liquor Flash Tank
IH	Integral Heater
L	Liquor rate
LF	Feed Liquor rate
LFT	Liquor Flash Tank
LFINO	Outgoing Liquor stream rate from FINisher effect
LLFTO	Outgoing Liquor stream rate from Liquor Flash Tank
LO	Outgoing Liquor stream rate

LP   Product Liquor rate

m   Number of auxiliary features [liquor flash tanks,
          condensate flash tanks, integral heaters, vapor
          bleed points, finisher effect, finisher condensate
          flash tanks] available

MF   Multiple Feed stream rate

n   Number of bodies

N   Number of effects

N_1 Number of liquor flash tanks

N_2 Number of condensate flash tanks

N_3 Number of integral heaters

N_4 Number of feed streams

N_5 Number of vapor bleed points

N_6 Number of finisher effects

N_7 Number of finisher condensate flash tanks

N_f Degrees of freedom

N_r Number of restrictions

N_v Number of variables

NFOR   Number of liquor flash tanks receiving liquor before
          finisher effect

NVORD   Body Number to whose steam chest Vapors from finisher
          effect enter

P   Pressure of the stream

Q   Heat transfer rate

QB   Heat duty of vapor Bleed stream

QFIN	Heat transfer rate in FINisher effect
QIH	Heat transfer rate in Integral Heater
R	Area Ratio between bodies
RAB1	Area Ratio between two bodies of first effect
RIH	Specified area Ratio between Integral Heater and corresponding body
RIH1	Specified temperature differential ratio for Integral Heater
RL	Radiation Loss fraction in the evaporation plant
RLF	Radiation Loss fraction in the Finisher effect
S	Steam rate to first effect
S_1	Steam rate to first body of first effect
S_2	Steam rate to second body of first effect
S_c	Steam condensate rate
SE	Steam Economy
SFIN	Steam rate to FINisher effect
SPHT	Specific Heat
T	Temperature of the stream
TBPR	Sum of Boiling Point Rise in the effects
TC	Temperature of Condensate stream
TC_{N+1}	Saturation Temperature of vapors from last effect
TC_{n+1}	Saturation Temperature of vapors from last body
TFINO	Temperature of Outgoing liquor stream from FINisher effect
TI	Temperature of Incoming liquor stream

TIHI	Temperature of Incoming liquor stream to Integral Heater
TIHO	Temperature of Outgoing liquor stream to Integral Heater
TLFTO	Temperature of Outgoing liquor stream from Liquor Flash Tank
TMF	Total feed through Multiple Feed streams
TS	Temperature of Steam to first effect
TSFIN	Temperature of Steam to FINisher effect
U	Overall heat transfer coefficient
UIH	Overall heat transfer coefficient of Integral Heater
UFIN	Overall heat transfer coefficient of FINisher effect
V	Vapor rate
VB	Vapor Bleed stream rate
VBP	Vapor Bleed Point
VCFT	Vapor rate from Condensate Flash Tank
VDIFF	Difference in Vapor rate from two bodies of first effect
VFCFT	Vapor rate from Finisher Condensate Flash Tank
VFIN	Vapor rate from FINisher effect
VLFT	Vapor rate from Liquor Flash Tank
X	Mass fraction of solute in liquor
XLF	Mass fraction of solute in Feed Liquor
XLFINO	Mass fraction of solute in Outgoing Liquor stream from FINisher effect

XLLFTO   Mass fraction of solute in Outgoing Liquor stream
         from Liquor Flash Tank

XLP   Mass fraction of solute in Product Liquor

μ   Viscosity of liquor

CHAPTER 1

CHEMICAL PROCESS EVAPORATORS

Evaporators are used in a number of process applications for increasing the concentration of dissolved solids in the process liquor. Some of these applications include the following: apple and citrus fruit juices, milk, cane juice (sugar), brine (salt), caustic lye, aluminate liquor, spent pulping liquors, gelatin, vitamin, ammonium nitrate, urea, coffee extract, glycerine etc. Equipment used in the evaporation plant is generally classified as standard evaporator and long tube vertical (LTV) evaporators (climbing or falling film); forced circulation (FC) evaporators are used either for the final concentration when liquor viscosity tends to have an adverse effect on heat transfer rates or for systems requiring expensive tube material (S.S. and special alloys). Agitated thin film evaporators are used in special applications for handling systems which are heat sensitive and/or highly viscous. In the chemical process industries standard, LTV and FC type of evaporators units are quite common for a wide range of applications handling aqueous systems.

The evaporation plant, in general, can have N-effects with different heat recovery features like liquor flash tanks,

condensate flash tanks and liquor preheaters and also the
finisher effect. Process liquor flow can follow either
forward, backward, parallel or mixed pattern through the units
and also incorporate two tube pass arrangement in the first
effect. The plant can also have the facility to withdraw some
of the vapors from first few effects as vapor bleed streams.

Since the process engineering calculations of such
complex evaporation plants are quite involved, a general
computer program 'MEEDS' is developed in this work. In
addition to all complexities listed above, the program can
also account for boiling rise and radiation heat losses.

The program 'MEEDS' can be used for both design and
simulation studies of an evaporation plant. In design cal-
culations the program estimates the steam and heat transfer
surface requirements. In simulation studies it can either
compute the values of overall heat transfer coefficient and
steam requirement or predict changes in plant performance
and steam consumption resulting from fluctuations in input
parameters like steam pressure, feed conditions, product
concentration and vacuum. It can also predict the plant
performance when one of the effects is bypassed for maintenance
purposes. The program can also be used to recommend modifi-
cations to existing evaporation plants for improving the
performance and steam economy. A detailed analysis of process

design variables for evaporation plant has also been carried out to generate a list of necessary input parameters to be specified for process engineering calculations of any complex evaporation plant. Several design and simulation problems of   evaporation plants of diverse complexities for different process liquors have been solved by the program 'MEEDS' to demonstrate its versatility.

CHAPTER 2

COMMENTS ON OBJECTIVES AND PUBLISHED CALCULATION METHODS OF MULTIPLE EFFECT EVAPORATORS

2.1 Steam Economy and Capacity of Evaporation Plants:

Multiple effect evaporators are used in the process industries to accomplish a large increase in the concentration of the dissolved constituents. For example the concentration of kraft black liquors is raised from 12-15 per cent to 63 - 65 per cent, crude glycerine in spent soap lye from 8-10 per cent to 80-82 per cent, caustic soda solution from 10-12 per cent to 50-52 per cent, and cane juice from 13-15 per cent to 58-60 per cent. These plants generally have several of the following features: N-effects, liquor flash tanks, condensate flash tanks, liquor preheaters, finisher effect and vapor bleed points. Evaporation plant is designed for a specified capacity to give the product of desired concentration levels suitable for further treatment in the process. Capacity of the plant is represented as the hourly rate of evaporation for specified flow rate of feed and concentrations of inlet and exit streams. A related factor used in evaluating plant performance is the steam economy.

Steam economy of an evaporation plant is the ratio of the amount of water evaporated per unit weight of fresh steam consumed. The steam economy of a single effect evaporator is normally 0.75-0.95 depending upon feed and steam conditions and heat losses from the system. Steam economy can be increased to a theoretical maximum of N in a N-effect evaporation plant (N = number of effects) by sequential reuse of the vapors generated in the first effect as the heating medium for the following effects. The vapor from the last effect is connected to barometric/surface condensor and then to the vacuum system consisting generally of two stage ejectors using high pressure steam as motive fluid. Process liquor flows in forward, backward, parallel or mixed manner through the units depending upon flow rate and temperature of feed and physico-chemical characteristics of the liquor system. Steam economy can be further improved by reusing flash steam from steam condensate and liquor streams. Steam condensate from first effect is flashed in one or two stages in flash tanks and the flash vapors sent to one or more of the following effects; the condensate is normally returned to the boiler for steam production. The contaminated condensates from the second effect onwards also can be flashed sequentially either through the calendria of the succeeding (n-2) effects or through separate flash tanks; the combined contaminated condensate from the last effect steam chest is

either drained or used elsewhere in the factory.

The product liquor withdrawn from one of the first few effects operating under positive pressure also can be considered for heat recovery by flashing through product flash tanks in one or two stages. This accomplishes a further evaporation of 2-3 per cent and the reuse of flash steam can improve the steam economy of the plant.

The capacity as well as steam economy of the evaporation plant can be improved by preheating the intermediate liquor streams to the necessary boiling temperatures, particularly in backward flow liquor arrangement. This is done either in external heat exchanger (shell and tube, plate or spiral type) or internal heater forming an integral part of the evaporator effect.

Thermocompressors based on steam jet ejectors are also used to improve steam economy in some instances for raising the vapors to the desired steam pressure levels. Higher concentration levels are obtained with viscous systems by incorporation of a forced circulation evaporator (frequently called as finisher or concentrator) in the evaporation plant as an additional effect. The vapors from finisher and finisher steam condensate flash tanks are used in the main evaporation plant to improve steam economy.

A portion of the vapors generated in the first few effects of a multiple effect evaporator are sometimes withdrawn

as bleed stream for either preheating the feed solution or
for use elsewhere in the plant requiring low grade steam.

Steam economy can also be improved by raising the feed
temperature. Steam economy also increases with the decrease
in feed concentration. Similarly feed pattern also affects
the steam economy. The feed can be introduced to more than
one effect either in parallel or mixed arrangement to handle
large liquor rates and to improve the economy; steam economy
can also be improved by utilization of low pressure steam
which has lower heat of vaporization.

Capacity of the evaporation plant depends on heat
transfer rates governed by equation (2.1) for the individual
effects.

$$Q_i = U_i \, A_i (DT)_i \qquad\qquad (2.1)$$

U_i in the above equation represents the overall co-
efficient for heat transfer through the three major resistances
contributed by steam condensate film, tube wall and process
liquor film. Among these resistances, the resistance on the
process liquor side is quite significant. The liquor also
may have tendencies to form scale deposits on tube walls and
result in additional resistance across the scale deposit.

Each effect in the multiple effect evaporation plant
operates at a successively lower pressure levels and the last
effect is connected to vacuum. The overall temperature

difference available is the difference between the saturation
temperature of steam in the first effect and the temperature
corresponding to vacuum in the last effect. The overall
temperature difference is distributed across the different
effects. Due to the presence of solute in the process liquor
and effect of hydrostatic pressure, the temperature of the
liquor in the effect is somewhat higher than the saturation
temperature of vapors leaving the effect. This elevation in
boiling point (Boiling Point Rise, BPR) decreases the
temperature difference potential available for each effect
and hence must be included in process engineering calculations.

Overall heat transfer coefficient in multiple effect
evaporator for the different effects reflects changes in
physico-chemical properties of the liquor with progressive
increase in the concentration of the solution across the
units. The value of U depends upon a number of parameters of
the liquor system, hydrodynamic conditions and equipment
geometric factors. Amongst the engineering properties of the
liquor, viscosity is a particularly important parameter in
controlling U-values; viscosity depends upon composition,
concentration and temperature of the solution. In systems
consisting of polymeric organic constituents like pulp mill
black liquors, a sharp rise in viscosity is observed above
a concentration of about 35-40 per cent; backward feed

arrangement for the liquor flow is recommended in such cases so that the concentrated solution is handled in the first few effects at a higher temperature. An increase in liquor velocity improves U-value and also decreases the tendencies for scale formation. Increased liquor flow can be obtained by a two-pass arrangement in first few effects in backward feed arrangement. Forced circulation units are recommended for some viscous systems and also when scale deposit problems are likely to be severe. The U-value also depends upon heat flux which determines the heat transfer mechanisms. Amongst the other factors affecting the U-value, the length, diameter and thickness of tubes and material of construction. are also important. Heat transfer mechanisms and liquor flow patterns vary among the different types of evaporators and thus determine the values of overall heat transfer coefficient.

Since the overall heat transfer coefficient depends upon a number of factors, reliable U-values can only be obtained from experience from commercially operating plants. Reasonably reliable data can also be obtained from pilot plant runs using the desired commercial liquor system of interest. Literature reports U-values for some systems of commercial interest. It is desirable to have an empirical relation for estimating the values of overall heat transfer coefficient in a given application as a function of the several factors listed above. Generalised correlations of this type accounting for

the effect of all the variables on the values of overall
heat transfer coefficient are not available. In a few case
like sugar solution and paper mill black liquor correlations
of the type equation (2.2) and equation (2.3) have been
proposed which can be used for the range recommended by the
investigators [1, 2].

$$U = U[T, \mu, C_p] \tag{2.2}$$

$$U = U[\mu, q, T, (LF), (XLF)] \tag{2.3}$$

where,

   T   - Boiling temperature of liquid

   μ - Viscosity of the liquid

   C_p - Specific heat of the liquid

   q - Heat flux

   (LF) - Liquor feed rate

(XLF) - Concentration of liquor feed.

2.2 Process Engineering Aspects:

Process engineering calculations of evaporation plant
involve the solution of a system of mass and energy balances
and heat capacity equations. Evaporator calculations are
generally of an iterative nature based on a set of preliminary
values for the temperature distribution,until the desired
convergence is obtained. Such iterative calculations are

relatively simple for a plant having two or three effects.
For such simple problems, the methods proposed by Ray and
Carnahan [3] Bonilla [4] and Hassett [5] can be used. Wise [6]
and Oden [7] have suggested graphical methods for evaluating
the performance of existing evaporation plant based on flow
rates and operating data. However, with more than three
effects, the conventional trial and error methods become
tedious and time consuming and generally a shortcut procedure
is adopted which will approximate the results. Ray and
Carnahan [3] and Coates [8] have also suggested such shortcut
methods for evaporator design calculations. Skelland [9] has
derived an expression for the optimum duration for operating
multiple effect evaporators based on different economic
considerations and scale deposit problems. Itahara and
Stiel [10, 11] have developed a procedure for optimal design
of a simple evaporation plant by dynamic programming. Burdett
and Holland [12] have investigated the dynamic response of a
17-effect evaporation plant for desalination. Computer programs
'EVAPOCHALM' and 'INDUNS' have been developed by Jernquist
and coworkers [13] and Bolmstedt and coworkers [14, 15]
respectively for design and simulation of evaporation plants.
These programs are based on modular concept of compiling
flowsheets of evaporation plant. The module consists of
a unit cell representing the several possible components of a

single effect in the evaporation plant. The unit cell
comprises of evaporator vessel, CFT, LFT, heat exchanger,
line mixers and dividers. The flow sheet of the plant is
assembled in terms of the unit cells and represented by a
connection matrix in the program. Bolmstedt [16] has recently
presented another program DYNEFF which is modification of
INDUNS for simulation of the dynamic behaviour of a general
multiple effect evaporation plant. A major limitation of
the programs based on modular concept is that insufficient
details are furnished in the published articles even though
these programs are claimed to be of general nature. Hirth
and Sampat [17] have presented a systematic development of a
computer program for a multiple effect evaprator which can
handle up to 10 effects and includes auxiliary heat recovery
features like a liquor flash tanks, condensate flash tank and
feed flash tanks. However the computer program of Hirth and
Sampat is still not a general one applicable to any evaporation
plant. Thus this study was undertaken to develop a general
computer program for process design and simulation of complex
evaporation plants. The program to be developed should be
useful for any complex evaporation plant handling process
solution like sugar solution, kraft black liquor, glycerine
solution brine, aluminate liquor and several other liquors in
forward, backward, parallel or mixed flow patterns with
different features like any number of effects, liquor flash

tanks, condensate flash tanks, integral heaters, vapor
bleeding points and finisher. The program should also be
useful for the plant having two-tube passes (two bodies - 1A
and 1B) in the first effect. The program should be able to
account for radiation heat losses and the effect of boiling
point rise. In design calculations, the program should provide
values of steam and heat transfer surface requirements. In
simulation studies either it should be able to calculate values
of overall heat transfer coefficient and steam consumption or
predict   performance of an existing plant based on
operating data. In addition the program should take minimum
computer time for the different process calculations.

CHAPTER 3

ANALYSIS OF PROCESS DESIGN VARIABLES FOR EVAPORATION PLANT

Evaporation plant operates under certain physical and
process constraints to yield the desired product rate and
quality. These constraints are the usual design specifications
from equipment suppliers and also form the basis for the
process design guarantee given by the vendors for plant
performance. Design calculations evaluate heat transfer
surface and steam consumption for specified terminal conditions.
Similarly simulation predicts plant performance for a given
process system. Both design and simulation require a knowledge
of flow rate, temperature, pressure and concentration of various
streams in the plant. These can be obtained from detailed mass
and energy balances and heat transfer expressions for the
evaporation plant. While such relationships are relatively
few in number for a plant having one or two effects, the
complexities increase considerably with increasing number of
effects. In such cases, a design analysis approach of the
problem will facilitate the convergence of the desired design/
simulation calculations.

The design analysis provides the degree of freedom (N_f)
for the unit and is the difference between total number of
variables (N_v) and the number of restrictions (N_r) such as

temperature, pressure, rate and concentration identities
between streams as well as other inherent restrictions like
vapor liquid equilibrium and boiling point rise besides the
conservation equations. The degree of freedom gives the
number of variables to be specified to define the problem
completely. Process calculations will then converge to an
unique solution to the problem [18]. This chapter outlines
a rigorous design analysis procedure for any evaporation
plant. The method developed can be used to analyse both
design and simulation studies of multiple effect evaporation
plants.

3.1 Design:

In this section the results for a single effect are
considered at first and then extended for the general case
of N-effect system; special features like flash tanks,
integral heaters, vapor bleed points and finisher effects
are then included sequentially in developing a general expre-
ssion for the degree of freedom for any evaporation plant.

3.1.1 Single Effect:

A single effect evaporator is treated as a combi-
nation of a stream divider and heater; the former represents
the liquor side where feed is split into vapor and liquor
streams by a heat input stream and the latter denotes the
steam chest transferring the latent heat of condensation of

steam to the process liquor[Fig.(3.1)]. Boiling point rise is
assumed
/to be negligible for the initial analysis. Even though the
process liquor stream contains only two components (solvent,
solute), a general terminology of C is retained throughout
this analysis. Each stream is defined completely by (C+2)
variables denoting temperature, pressure, concentration and
rate. The divider element with three material streams and
one heat stream has a total of [3(C+2)+1] variables. The
solute being nonvolatile, concentration identities between
the vapor and liquor streams as well as feed and liquor streams,
each contribute (C-1) inherent restrictions. Additional
restrictions can be temperature and pressure identities
between vapor and liquor streams, overall material and energy
balances and an equilibrium condition between the boiling
liquid and vapor. These give the total number of restricting
relationships (N_r) as $[2(C-1) + 5] = 2C + 3$. The degrees of
freedom for the divider will then be $[(3C + 7) - (2C + 3)]$
$= (C + 4)$. Specification of the feed stream, pressure or
temperature of the effect and evaporation in the effect or
concentration of product or the heat transfer rate will
utilize these $(2C + 3)$ degrees of freedom.

The heater element has two single component material
streams and one heat stream to give $N_v = [2(3) + 1] = 7$. The
number of restricting relationships for this element is equal
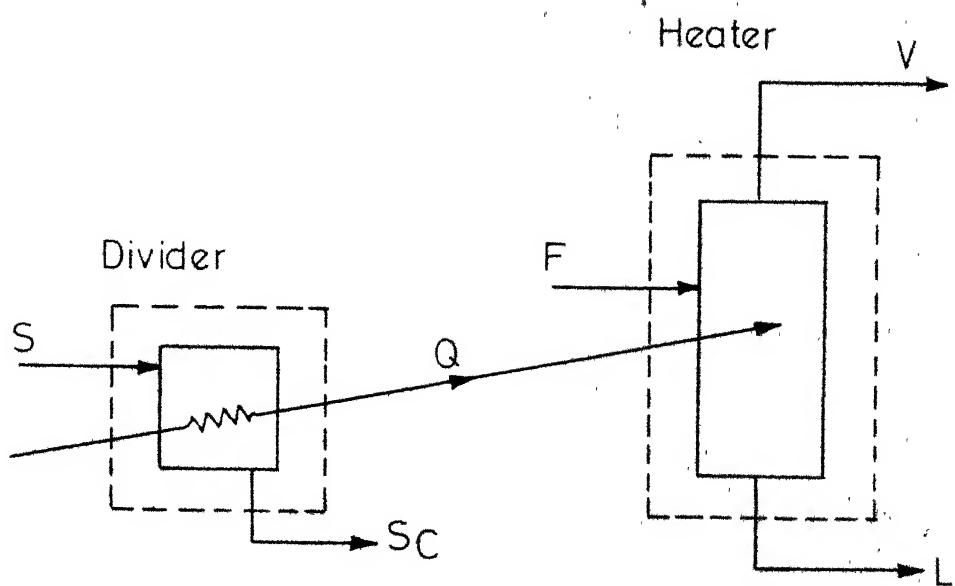
Fig. 3.1 - Single effect evaporation plant.
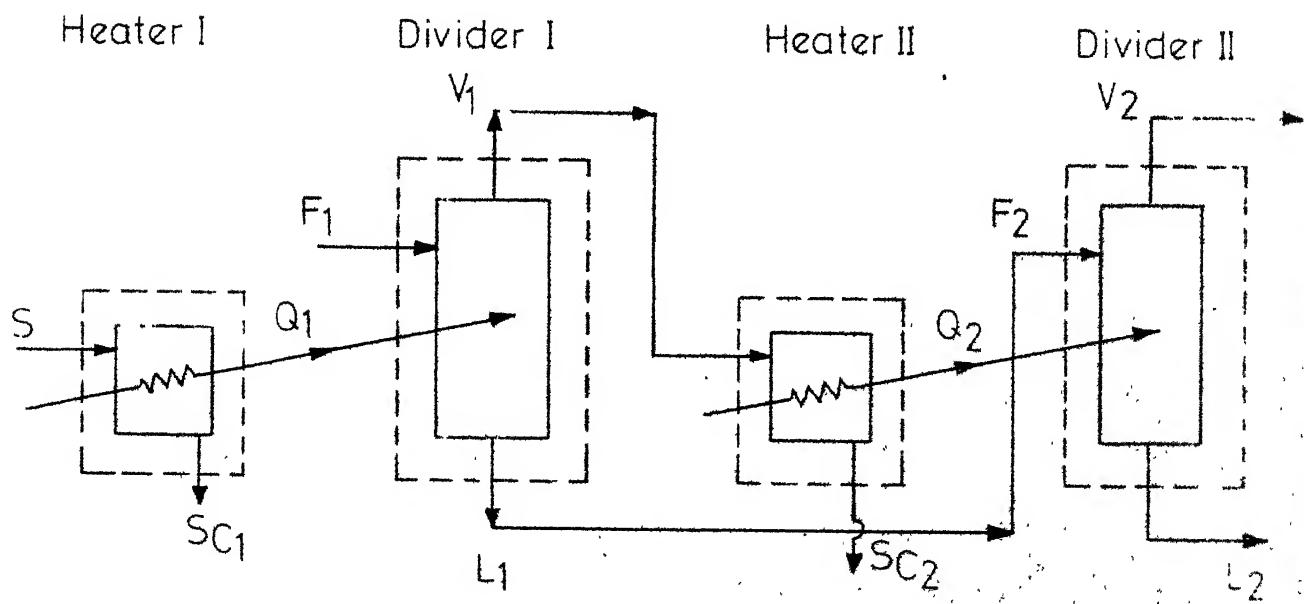
Fig 3.2 - Double effect evaporation plant.

to 5 and includes the flow rate, temperature and pressure
identities of saturated steam and condensate, energy balance
relation and vapor-liquid equilibrium. Thus the heater will
have 2 degrees of freedom which can be used in specifying
pressure or temperature of steam and flow rate of steam or
the rate of heat transfer.

The degree of freedom for the combination of divider
and heater is the difference between the sum of the degrees
of freedom of the two elements and the variables associated
with the interstreams connecting the elements. Degrees of
freedom for the combination are $[(C+4) + 2-1] = (C+5)$.

The fundamental equation of heat transfer in the
effect can be given by equation (3.1).

$$Q = U.A.(DT) \qquad\qquad (3.1)$$

Heat transfer rate Q is fixed by the specifications
discussed above and consequently for design calculations,
area can be obtained from equation (3.1). Thus equation (3.1)
introduces two more variables (U and A) for the evaporator
with a net increase in degrees of freedom of evaporator by
one.

Degrees of freedom for the single-effect evaporator is
therefore $[(C+5) + 1] = (C+6)$, of which $(C+3)$ are utilized for
specifications of feed stream and U of the evaporator and
one from each of the following groups of variables is selected

for the remaining degrees of freedom.

1. Steam pressure or temperature

2. Effect pressure or temperature

3. Steam rate, product concentration or total evaporation.

3.1.2 Multiple Effect Evaporator:

In a double-effect system, two evaporator units similar to Fig. (3.1) are connected in series as shown in Fig. (3.2). In this arrangement, vapor and liquor from the first effect go to the second effect and these constitute the interstreams with a total of $[(C+2) + 3]$ variables; vapor stream has one temperature-pressure equilibrium. The single unit being the repeating unit contributes a value of one to the repetition variable. Thus the degrees of freedom for the double-effect combination will be given by equation (3.2)

$$N_f = 2(C+6) - [(C+5) - 1] + 1 = C+9 \quad (3.2)$$

The above analysis can be extended to a N-effect evaporation plant to give equation (3.3) for the degrees of freedom.

$$N_f = N(C+6) - (N-1)(C+4) +1 = C+2N + 5$$

$$(3.3)$$

Specifications of feed stream and number of effects utilize $(C+3)$ degrees of freedom in addition to N for speci-

fication of design U-values for the effects. The balance
(N+2) is utilized for selecting variables from each of the
following groups.

     1. Steam pressure or temperature

     2. Steam rate, total evaporation or product concentration

     3. Pressure or temperature of each effect or (N-1)
        area ratios between N effects and temperature or
        pressure in the last effect.

    Equation (3.3) is valid for forward, backward, parallel
as well as mixed flow patterns of the process liquor.

3.1.3.1 Flash Tanks:

    Flash tank for stream condensate or product liquor
can be considered as a divider with no heat stream (adiabatic
operation). The degrees of freedom, therefore, will be (C+3),
which may be used in specifying feed stream and pressure of
the flash tank. Flash tank however does not alter the design
analysis of the evaporation plant since the feed to flash
tank is an interstream and there exists pressure identity
between flash tank and one of the effects receiving the flash
vapors.

    However, repetition variables specifying the number
of product and steam condensate flash tanks (N_1 and N_2) will
increase the degrees of freedom by 2.

$$N_f = (C + 2N + 5) + 2 = C + 2N + 7 \qquad (3.4)$$

3.1.3.2 Integral Heaters:

The integral heater has two liquor streams and one heat stream. Flow rate, concentration and pressure identities of the two liquor streams and restricting relations like energy balance and heat transfer rate expressions give the degrees of freedom for each integral heater as $[(2(C+2)+1+2) - (C+1) - 2] = (C+4)$. These degrees of freedom can be utilized in specifying feed stream, exit liquor temperature and U-value for the heater.

Liquor stream becomes interstream in the evaporation plant leaving only 2 degrees of freedom for each IH giving equation (3.5) for the degrees of freedom of a plant having N_3 integral heaters.

$$N_f = (C+2N+7) + 2N_3+1 = C+2N + 2N_3 + 8 \quad (3.5)$$

3.1.3.3 Feed Pattern:

Feed to multiple-effect-evaporation plant can be admitted to any effect or two or more units in parallel. It is also possible to combine the liquor overflow from any effect with the liquor input of any other effect. The analysis presented above will be modified by the addition of extra specifications for the feed streams. With N_4 feed streams, equation (3.5) becomes

$$N_f = (C+2N+2N_3+8) + (N_4-1)(C+2) + 1$$
$$= N_4(C+2) + 2N + 2N_3 + 7 \quad (3.6)$$

3.1.3.4 Vapor Bleed Points:

Vapor bleed point (VBP) is essentially a stream divider without any heat stream; (C+3) degrees of freedom can be utilized for specification of vapor stream and either rate or heat duty of bleed stream. These vapor streams become interstreams in the evaporation plant and thus contribute only one degree of freedom corresponding to each VBP. So the degrees of freedom of the plant increase by (N_5+1) corresponding to N_5 vapor bleed points and one repetition variable.

$$N_f = [N_4(C+2) + 2N + 2N_3 + 7] + (N_5+1)$$
$$= N_4(C+2) + 2N + 2N_3 + N_5 + 8 \qquad (3.7)$$

3.1.3.5 Finisher Evaporator:

Finisher evaporator can be treated as one more unit in the normal multiple-effect-evaporation plant and has a separate stream supply; so the finisher has (C+6) degrees of freedom. In combination with N-effect plant, feed stream to finisher is an interstream and pressure of finisher is equal to the pressure of the stream chest of the effect where its vapor line is connected and so the additional degrees of freedom for the evaporation plant having finisher evaporator will be [(C+6) - (C+2) - 1] = 3. One of these three degrees of freedom can be utilized for specification of U-value of finisher and other two for specifying one variable from each of the following groups:

1. Finisher stream pressure **or** temperature

2. Steam rate, evaporation or product concentration from finisher

Degrees of freedom of N-effect evaporation plant with N_6 finisher evaporators will be given by equation (3.8).

$$N_f = [N_4(C+2) + 2N + 2N_3 + N_5 + 8] + 3N_6 + 1$$
$$= N_4(C+2) + 2N + 2N_3 + N_5 + 3N_6 + 9 \qquad (3.8)$$

The addition of N_7 condensate flash tanks for finisher stream will increase the degrees of freedom of plant by only one, as discussed earlier to give equation (3.9).

$$N_f = N_4(C+2) + 2N + 2N_3 + N_5 + 3N_6 + 10 \qquad (3.9)$$

3.1.3.6 Boiling Point Rise:

In the above analysis, boiling point rise was assumed to be negligible. Saturation temperature of vapor along with BPR of the liquor across the unit would give the exit liquor temperature. Therefore the modification in equation (3.9) for BPR in effects, LFT and finisher gives equation (3.10).

$$N_f = [N_4(C+2) + 2N + 2N_3 + N_5 + 3N_6 + 10] + N + N_1 + N_6$$
$$= N_4[C+2] + 3N + N_1 + 2N_3 + N_5 + 4N_6 + 10$$
$$\qquad (3.10)$$

Equation (3.10) thus provides the degrees of freedom of complete N-effect evaporation plant with liquor flash tanks (N_1), fresh steam condensate flash tanks (N_2), integral

heaters (N_3), feed streams (N_4), vapor bleed points (N_5), finishers (N_6) and finisher stream condensate flash tanks (N_7) and includes the effect of BPR of the process liquor. For design case these degrees of freedom may be utilized by the different specifications summarized in Table (3.1).

3.2 Simulation:

The degrees of freedom for the simulation calculations of an evaporation plant do not differ from the degrees of freedom for design case and are therefore given by the same equation (3.10). The utilization of the degrees of freedom differs in the two cases. For the case of plant design, values of overall heat transfer coefficient for the effects, IH and finishers are specified whereas for simulation purposes the heat transfer surfaces of these units are specified.

Thus the equation (3.10) gives the degree of freedom for both design and simulation calculations of the evaporation plant having all facilities like LFT, CFT, IH, VBP, FIN and FCFT. In cases where the evaporation plant does not have some of these auxiliary features, equation (3.10) is modified to equation (3.11); m equals the number of auxiliary features present in the plant and has a maximum value of 6 when all the features listed above are included in the plant.

$$N_f = N_4(C+2) + 3N + N_1 + 2N_3 + N_5 + 4N_6 + m + 4 \qquad (3.11)$$

TABLE 3.1

SPECIFICATION OF DESIGN VARIABLES FOR MULTIPLE-EFFECT EVAPORATION PLANT

Variables specified	Number
N, N_1, N_2, N_3, N_4, N_5, N_6, N_7	8
P or T of steam to first effect	1
Steam rate, total evaporation or product concentration	1
N_4 fresh feed streams	$N_4(C+2)$
U for effects	N
BPR for effects	N
T or P of effects or (N-1) area ratios between N effects and T or P of last effect	N
BPR in LFT	N_1
Exit liquor stream temperature from IH	N_3
U for IH	N_3
Rate or heat duty of bleed streams	N_5
P or T of finisher steam	N_6
Steam rate, evaporation or product concentration from finishers	N_6
BPR in finishers	N_6
U for finishers	N_6
Total	$N_4(C+2) + 3N + N_1 + 2N_3 + N_5 + 4N_6 + 10$

Design analysis for an evaporation plant having
two tube passes in some of the effects is given in Appendix A.

A typical evaporation plant shown in   Fig. (3.3)
is considered for illustrating design analysis procedures
discussed thus far. For this plant $N=6$, $N_1=1$, $N_2=2$, $N_3=5$,
$N_4=2$, $N_5=2$, $N_6=1$ and $N_7=2$.

The degrees of freedom available for detailed process
engineering calculations is 53 according to equation (3.11)
with m=6. This is also verified independently from a detailed
consideration of the total variables and restricting relation-
ships for the evaporation plant of Fig. (3.3). Table (3.2)
summarizes the various contributions to the total number of
variables (207) and Table (3.3) gives a list of all the
restricting relationships (154). The difference of these two
values giving degrees of freedom (53), is in perfect agree-
ment with the value based on equation (3.11).

After utilizing the degrees of freedom in specifying
the different variables as discussed above, the solution of
different expressions representing material and energy
balances and heat transfer rates will lead to an unique
solution of the problem.

Fig 3.3 - Sextuple effect evaporation plant with LFT, CFT, IH,
FIN, FCFT, VBP.

LFT₁   FIN   FCFT₁   FCFT₂   CFT₂   CFT₁

Liquor
Vapor
Condensate
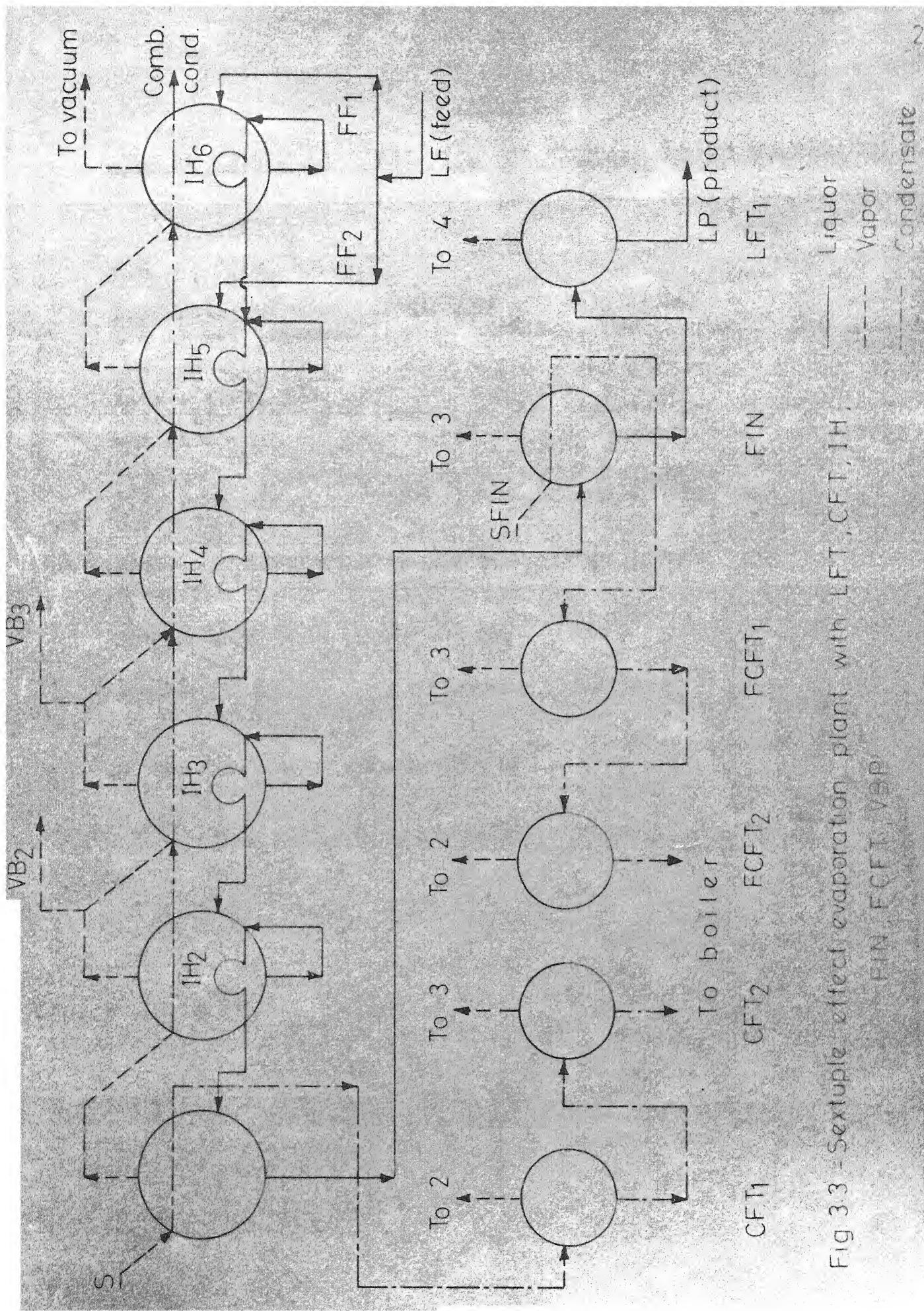
TABLE 3.2

LIST OF INDEPENDENT VARIABLES FOR SEXTUPLE EFFECT EVAPORATION P:

Variables	Number
$N, N_1, N_2, N_3, N_4, N_5, N_6, N_7$	8
T,P, rate and concentration of two feed streams and 13 exit streams from each effect, IH, FIN, LFT	60
T,P and rate of 12 outgoing vapor streams from each effect, FIN, LFT, CFT, and FCFT, 2 vapor bleed streams and 2 steam line for first effect and FIN.	48
T,P and rate of 11 outgoing condensate streams from each effect calendria, FIN calendria, CFT and FCFT	33
Number of heat transfer streams in each effect, IH, FIN and 2 bleed streams	14
BPR in each effect, FIN and LFT	8
Number of temperature difference potentials in each effect, IH and FIN	12
U and A for each effect, IH and FIN	24
Total	207

TABLE 3.3

LIST OF RESTRICTIONS AND RELATIONSHIPS FOR SEXTUPLE EFFECT
EVAPORATION PLANT

Restrictions/Relationships	Number
Material and energy balance over each effect, calendria, FIN, FIN calendria, LFT, CFT, FCFT, IH and Bleed point	52
Concentration identity between feed and outgoing liquor streams for each effect, FIN and IH and between vapor and outgoing liquor streams for each effect and FIN	19
Temperature identity between outgoing vapor and liquor streams for each effect, CFT, FIN, FCFT and LFT and between incoming and outgoing fluids for calendria of each effect and FIN	19
Pressure identity between outgoing vapor and liquid for each effect, CFT, FIN, FCFT, LFT and between incoming and outgoing fluid for calendria of each effect and FIN and for each IH	24
Temperature-pressure equilibrium relation for each vapor stream: S, SFIN, V, VBLEED, VFIN, VCFT, VFCFT and VLFT	16
Heat transfer rate expression for each effect, IH and FIN	12
Temperature difference potential for each effect, IH and FIN	12
Total	154

CHAPTER 4

MODEL DEVELOPMENT FOR PROCESS ENGINEERING CALCULATIONS OF EVAPORATION PLANT

A model for multiple effect evaporation plant is
developed in this chapter for use in either design or
simulation calculations. Material and energy balance
equations and heat transfer rate expressions are used as
the basis for the model. Design procedure is developed
using heat capacity equations for the distribution of over-
all temperature difference driving potential across the
individual effects. Material and energy balance equations
are used for the distribution of evaporator duty and esti-
mation of steam consumption and the required heat transfer
surface obtained from rate equations. A simple case of
sextuple effect evaporation plant depicted in Figure (4.1)
is considered at first for illustrating the methodology
involved. Several modifications of this simple design are
considered next to develop a general scheme for multiple
effect evaporation plant. Thereafter, changes necessary in
the calculation procedure are then discussed for performance
evaluation or simulation of the plant. The last section of
this chapter deals with the computer program outlining the
associated input data, arrays, counter data and subroutines/

function subprograms used in the program and a list of
output parameters obtainable.

4.1 Design:

For the sextuple effect evaporation plant given in
Fig. (4.1), temperature difference driving force and rate
of heat transfer in each unit are represented by equations (4.1)
and (4.2).

$$(DT)_i = (TC)_i - (TO)_i \qquad (4.1)$$

$$Q_i = U_i A_i (DT)_i \qquad (4.2)$$

$(TC)_i$ - saturation temperature of vapors from $(i-1)$ effect.

$(TO)_i$ - temperature of liquor leaving (i) effect

The overall temperature difference driving potential
available is the difference between the saturation temperatures
of fresh steam, (TS) and vapor leaving the last effect, $(TC)_{N+1}$.

$$(DT)_i = (TS) - (TC)_{N+1} \qquad (4.3)$$

Equations (4.4) and (4.5) give the effect of BPR on $(TC)_i$
and $(DT)_i$.

$$(TC)_i = (TO)_{i-1} - (BPR)_{i-1} \qquad (4.4)$$

$$(DT)_i = (TS) - (TC)_{N+1} - (TBPR) \qquad (4.5)$$

where $(TBPR) = \sum_{i=1}^{N} (BPR)_i$

Equations (4.6) can be written to represent $(N-1)$
relationships each for any two consecutive units of N effects

To vac.

Comb cond.

6   5   4   3   2   1

S

LF (feed)

To 3

LP (product)

To 3   To boiler

To 2

CFT₁   CFT₂

LFT₁

Liquor
Vapor
Condensate
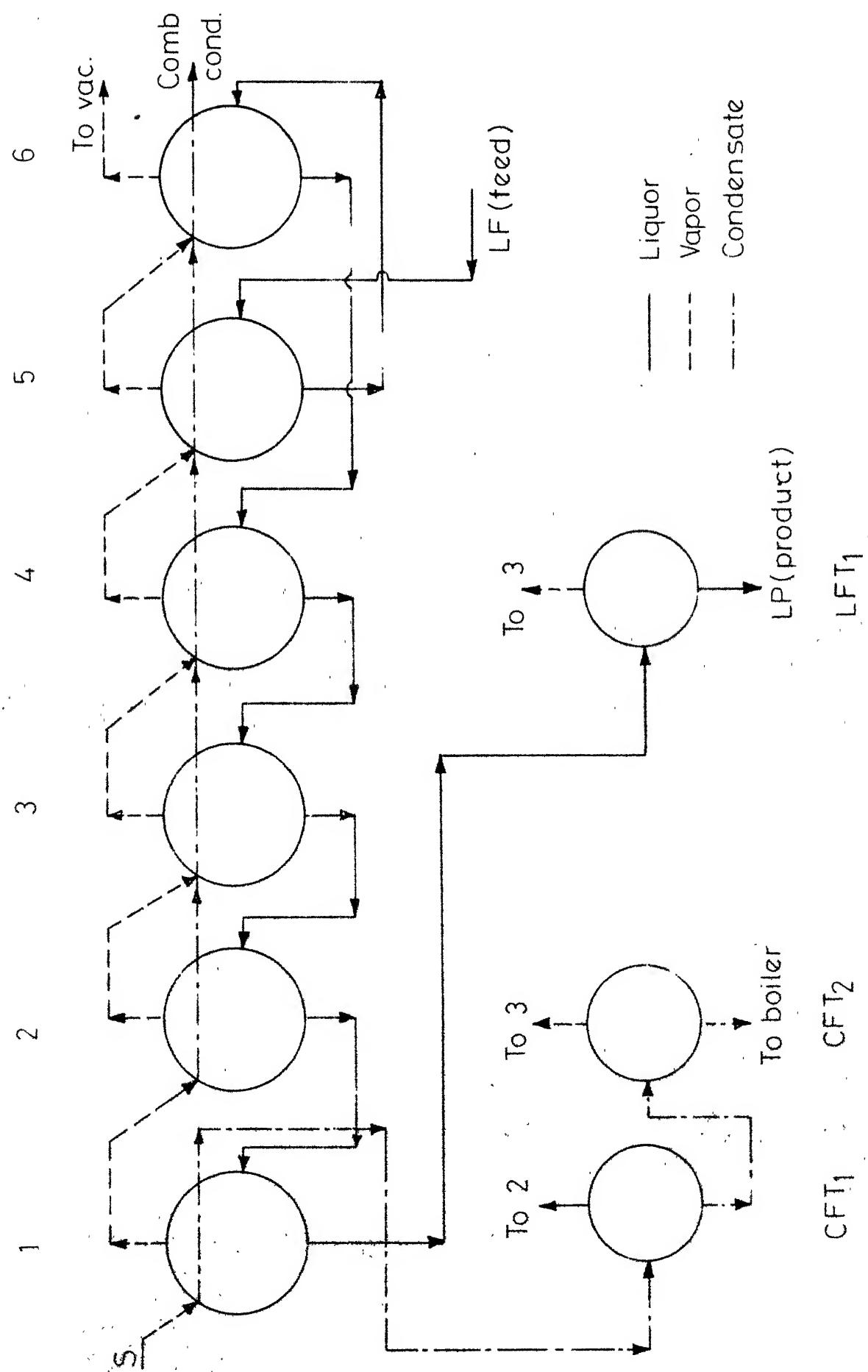
Fig. 4.1 - Sextuple effect six body evaporation plant with
LFT, CFT (Plant-2).

of the plant.

$$[\frac{U_i(DT)_i}{Q_i} - \frac{1}{R_i} \frac{U_{i+1}(DT)_{i+1}}{Q_{i+1}}] = 0 \qquad (4.6)$$

$$[i=1 \text{ to } (N-1)]$$

where $R_i = A_i/A_{i+1}$

Equations (4.5) and (4.6) form a set of N independent expressions which can be solved for temperature distribution $(DT)_i$ by any method of matrix invertion like Gauss Jordon method with maximum pivot strategy.

Material balances around each effect is given by equations (4.7) and (4.8) denotes the overall material balance.

$$(LO)_1 = (LO)_2 - V_1 \qquad (4.7.1)$$

$$(LO)_2 = (LO)_3 - V_2 \qquad (4.7.2)$$

$$(LO)_3 = (LO)_4 - V_3 \qquad (4.7.3)$$

$$(LO)_4 = (LO)_6 - V_4 \qquad (4.7.4)$$

$$(LO)_5 = (LF) - V_5 \qquad (4.7.5)$$

$$(LO)_6 = (LO)_5 - V_6 \qquad (4.7.6)$$

$$(LF) - (LO)_1 = V_1 + V_2 + V_3 + V_4 + V_5 + V_6 \qquad (4.8)$$

Equations (4.7) canbe rearranged in terms of feed rate (LF) and vapor rates V_i according to equation (4.9).

$$(LO)_5 = (LF) - V_5 \tag{4.9.1}$$

$$(LO)_6 = (LF) - V_5 - V_6 \tag{4.9.2}$$

$$(LO)_4 = (LF) - V_4 - V_5 - V_6 \tag{4.9.3}$$

$$(LO)_3 = (LF) - V_3 - V_4 - V_5 - V_6 \tag{4.9.4}$$

$$(LO)_2 = (LF) - V_2 - V_3 - V_4 - V_5 - V_6 \tag{4.9.5}$$

$$(LO)_1 = (LF) - V_1 - V_2 - V_3 - V_4 - V_5 - V_6 \tag{4.9.6}$$

Material balances around liquor and condensate flash tanks are represented by equations (4.10) and (4.11).

$$(LLFTO)_1 = (LO)_1 - (VLFT)_1 \tag{4.10}$$

$$(CCFTO)_1 = S - (VCFT)_1 \tag{4.11.1}$$

$$(CCFTO)_2 = (CCFTO)_1 - (VCFT)_2 \tag{4.11.2}$$

The set of equations (4.12) denotes energy balances for the six effects

$$S[(HS) - (HC)_1] - V_1(HV)_1 = (LO)_1(HLO)_1 - (LO)_2(HLI)_1 \tag{4.12.1}$$

$$V_1[(HV)_1 - (HC)_2] + (VCFT)_1[(HVCFT)_1 - (HC)_2] - V_2(HV)_2$$
$$= (LO)_2(HLO)_2 - (LO)_3(HLI)_2 \tag{4.12.2}$$

$$[V_1 + (VCFT)_1][(HC)_2 - (HC)_3] + V_2[(HV)_2 - (HC)_3]$$
$$+ (VLFT)_1[(HVLFT)_1 - (HC)_3] + (VCFT)_2[(HVCFT)_2 - (HC)_3]$$
$$- V_3(HV)_3 = (LO)_3(HLO)_3 - (LO)_4(HLI)_3 \tag{4.12.3}$$

$$[V_1 + V_2 + (VLFT)_1 + (VCFT)_1 + (VCFT)_2][(HC)_3 - (HC)_4] + V_3[(HV)_3 - (HC)_4]$$

$$-V_4(HV)_4 = (LO)_4(HLO)_4 - (LO)_6(HLI)_4 \qquad (4.12.4)$$

$$[V_1 + V_2 + V_3 + (VLFT)_1 + (VCFT)_1 + (VCFT)_2][(HC)_4 - (HC)_5]$$

$$+V_4[(HV)_4 - (HC)_5] - V_5(HV)_5 = (LO)_5(HLO)_5 - (LF)(HLI)_5 \qquad (4.12.5)$$

$$[V_1 + V_2 + V_3 + V_4 + (VLFT)_1 + (VCFT)_1 + (VCFT)_2][(HC)_5 - (HC)_6]$$

$$+ V_5[(HV)_5 - (HC)_6] - V_6(HV)_6 = (LO)_6(HLO)_6 - (LO)_5(HLI)_6 \qquad (4.12.6)$$

Equations (4.13) and (4.14) give the energy balances for liquor and condensate flash tanks.

$$(VLFT)_1(HVLFT)_1 = (LO)_1(HLO)_1 - (LLFTO)_1 (HLLFTO)_1 \qquad (4.13)$$

$$(VCFT)_1(HVCFT)_1 = S(HC)_1 - (CCFTO)_1 (HCCFTO)_1 \qquad (4.14.1)$$

$$(VCFT)_2(HVCFT)_2 = (CCFTO)_1(HCCFTO)_1 - (CCFTO)_2(HCCFTO)_2 \qquad (4.14.2)$$

Overall material balance for the evaporation plant can be written as equation (4.15).

$$\sum_{i=1}^{6} V_i + (VLFT)_1 = (LF) - (LP) \qquad (4.15)$$

Equations (4.12.2) to (4.12.6), (4.13) and (4.15) form seven independent equations to be solved for the seven unknowns – V_i and $(VLFT)_1$.

With values V_i known, the rate of heat transfer in first effect and steam requirement S can be calculated by equations (4.16) and (4.17).

$$Q_1 = V_1(HV)_1 + (LO)_1 (HLO)_1 - (LO)_2 (HLI)_1 \qquad (4.16)$$

$$S = \frac{Q_1}{[(HS)-(HC)_1]} \qquad (4.17)$$

Rearranging equations (4.14), vapor flow rates from condensate flash tanks can be calculated from (4.18).

$$(VCFT)_1 = \frac{S[(HC)_1 - (HCCFTO)_1]}{[(HVCFT)_1 - (HCCFTO)_1]} \qquad (4.18.1)$$

$$(VCFT)_2 = \frac{(CCFTO)_1[(HCCFTO)_1 - (HCCFTO)_2]}{[(HVCFT)_2 - (HCCFTO)_2]} \qquad (4.18.2)$$

Heat transfer rates in the other effects are given by equations (4.19).

$$Q_2 = V_1[(HV)_1 - (HC)_2] + (VCFT)_1[(HVCFT)_1 - (HC)_2] \qquad (4.19.1)$$

$$Q_3 = [V_1+(VCFT)_1][(HC)_2-(HC)_3] + V_2[(HV)_2-(HC)_3]$$
$$+(VCFT)_2[(HVCFT)_2 - (HC)_3] + (VLFT)_1[(HVLFT)_1-(HC)_3] \qquad (4.19.2)$$

$$Q_4 = [V_1+V_2+(VLFT)_1+(VCFT)_1+(VCFT)_2][(HC)_3-(HC)_4]$$
$$+V_3[(HV)_3 - (HC)_4] \qquad (4.19.3)$$

$$Q_5 = [V_1 + V_2 + V_3 + (VLFT)_1 + (VCFT)_1 + (VCFT)_2]$$
$$[(HC)_4 - (HC)_5] + V_4[(HV)_4 - (HC)_5] \qquad (4.19.4)$$

$$Q_6 = [V_1 + V_2 + V_3 + V_4 + (VLFT)_1 + (VCFT)_1 + (VCFT)_2]$$
$$[(HC)_5 - (HC)_6] + V_5[(HV)_5 - (HC)_6] \qquad (4.19.5)$$

Thus equations (4.1) to (4.19) give the relation-
ships necessary for design of the multiple effect evaporation
plant of Fig. (4.1). This plant has 29 degrees of freedom
according to equation (3.11) which can be specified as listed
in Table (4.1).

The solution of equations (4.1) to (4.19) involves an
iterative procedure. Initially evaporation in each effect
is assumed to be equal and evaporation in LFT is assumed to
be 1.0 per cent of total evaporation. The heat transfer rate
in each effect is also assumed to be equal to 10^5kW. It is
also assumed initially that no flashing is taking place in CFT.

Material balance equations (4.9) and (4.10) provides
the flow rates and concentration of different liquor streams
and equations (4.5) and (4.6) give the initial (DT) distribution.
Knowing temperatures, enthalpies of the various streams can
readily be calculated and then energy balance equations (4.12.2)
to (4.12.6), (4.13) and overall material balance equation (4.15)
gives evaporation V_i in each effect and in LFT. So Q-values
can be calculated with the help of equations (4.16) and (4.19),

TABLE 4.1: SPECIFICATIONS OF DESIGN VARIABLES FOR
EVAPORATION PLANT (PLANT-2)

Variables Specified	Number
Number of units, LFT,CFT, feed streams	4
Feed stream (T,P, rate and concentration)	4
Steam temperature to first effect	1
Product concentration	1
U for effects	6
Area ratios R_i among 6 effects	5
Saturation vapor temperature in last effect	1
BPR in effects	6
BPR in LFT	1
Total	29

the steam requirement by equation (4.17) and amounts of
flashing $(VCFT)_i$ by equations (4.18). These values of V_i are
compared with their initial values and the iterative procedure
is continued till the V_i converge within a specified limit
(1.0 kg) and finally A_i and steam economy can be calculated.

4.2. Process Design Modifications for Evaporation Plant:

The plant considered thus far is a relatively simple one
with feed introduced into any one of six effects and with
recovery of flash steam from steam condensate and product
liquor streams, similar to the case considered by Hirth and
Sampat [17] in their computer program for design or performance
check of multiple effect evaporation plant. Several modifi-
cations are possible for improving steam economy, efficient
use of heat transfer surface and for handling liquors which
are viscous or lead to scale deposition problems. Some of
the variations include parallel and mixed feed arrangement,
two tube passes in first few effects, internal/external liquor
preheaters, finisher effect and vapor bleed streams.

4.2.1 Parallel Feed:

Feed liquor can be introduced to two effects in
parallel and the overflow liquors combined and routed through
the other units. Figure (4.2) illustrates a case where feed
is admitted to fifth and sixth effects in parallel.
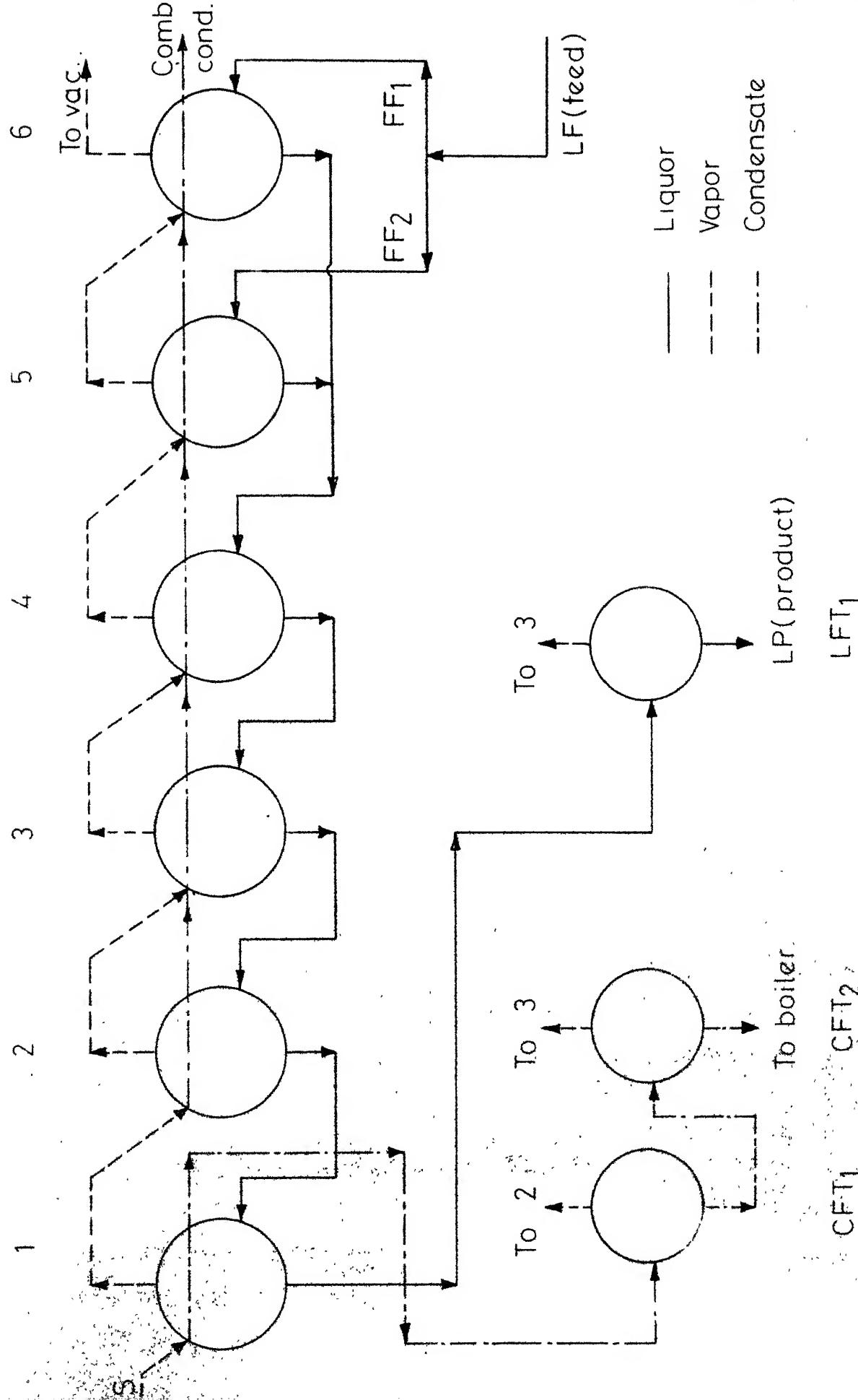
Fig. 4.2 — Sextuple effect six body evaporation plant with LFT, CFT

(Plant-3)

Material balance equations for fifth and sixth effects (4.9.1) and (4.9.2) are modified to give equations (4.20).

$$(LO)_6 = (FF)_1 - V_6 \qquad (4.20.1)$$

$$(LO)_5 = (FF)_2 - V_5 \qquad (4.20.2)$$

Changes are also necessary in heat balance equations (4.12.4) to (4.12.6) for fourth, fifth and sixth effects giving equations (4.21).

$$[V_1 + V_2 + (VLFT)_1 + (VCFT)_1 + (VCFT)_2][(HC)_3 - (HC)_4]$$
$$+ V_3[(HV)_3 - (HC)_4] - V_4(HV)_4 = (LO)_4(HLO)_4 - [(LO)_5 + (LO)_6] \cdot$$
$$(HLI)_4 \qquad (4.21.1)$$

$$[V_1 + V_2 + V_3 + (VLFT)_1 + (VCFT)_1 + (VCFT)_2][(HC)_4 - (HC)_5]$$
$$+ V_4[(HV)_4 - (HC)_5] - V_5(HV)_5 = (LO)_5(HLO)_5 - (FF)_2(HLI)_5$$
$$(4.21.2)$$

$$[V_1 + V_2 + V_3 + V_4(VLFT)_1 + (VCFT)_1 + (VCFT)_2][(HC)_5 - (HC)_6]$$
$$+ V_5[(HV)_5 - (HC)_6] - V_6(HV)_6 = (LO)_6(HLO)_6 - (FF)_1(HLI)_6$$
$$(4.21.3)$$

4.2.2 <u>Two-Tube-Passes in First Effect:</u>

With two tube passes in first one or two effects , each of these effects is assumed to consist of two bodies. Thus the plant shown in Fig. (4.3) will be a sextuple effect seven body system with N=6 and n=7. For process calculations

42
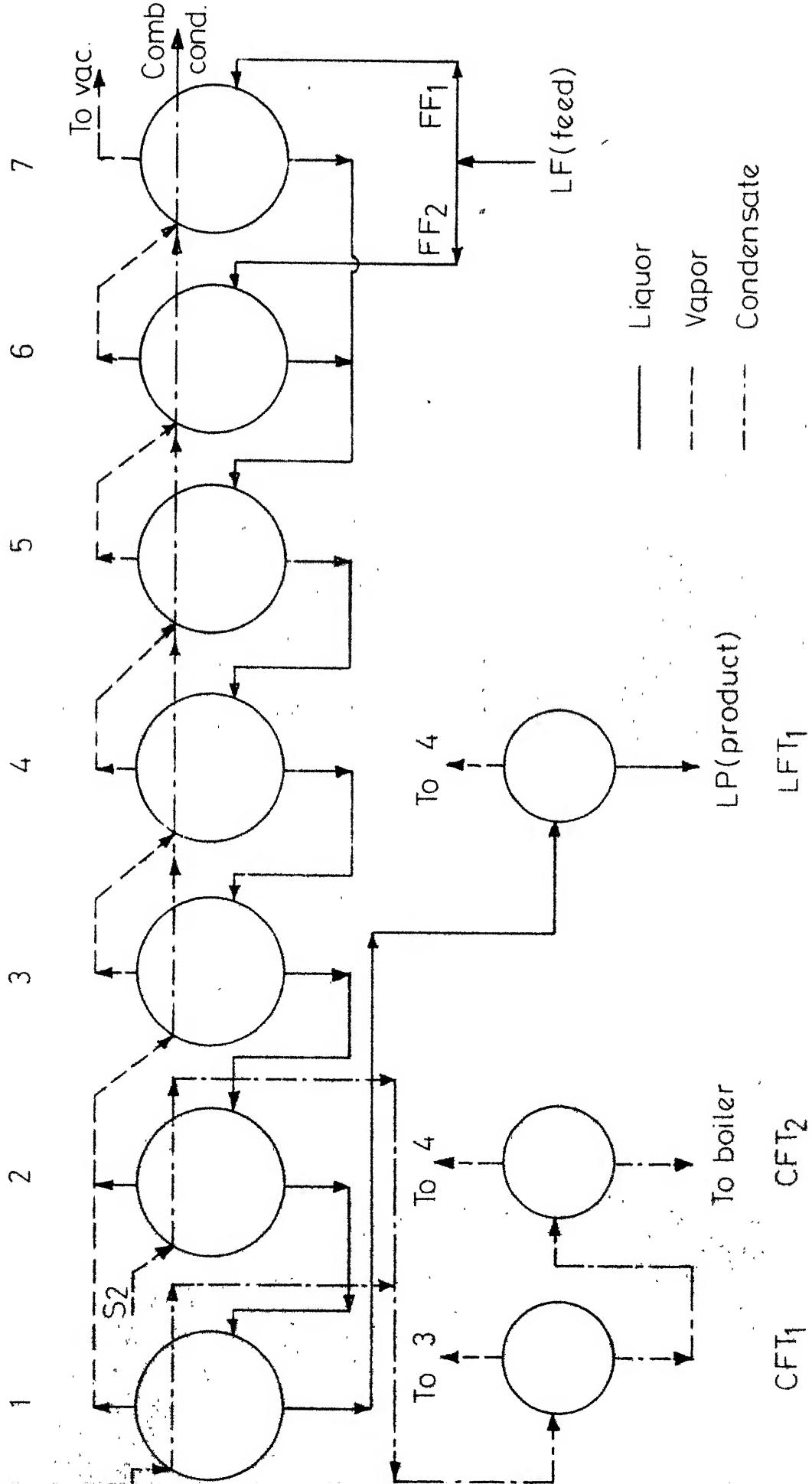
Fig. 4.3.—Sextuple effect seven body evaporation plant with LFT, CFT (Plant-8).

the bodies are numbered sequentially 1 to 7, with 1 and 2
denoting the two passes of the first effect. The two bodies
of the first effect are assumed to have separate steam
consumptions (S_1, S_2) and common vapor line of the two bodies
is connected to the steam chest of the adjacent effect.

Equations for (DT) across the first two bodies can be
derived as given below, based on equations (4.3) and (4.4).

$$(TC)_3 = (TO)_1 - (BPR)_1 = (TO)_2 - (BPR)_2 \qquad (4.22)$$

$$(DT)_1 = (TS) - (TO)_1 \qquad (4.23.1)$$

$$(DT)_2 = (TS) - (TO)_2 \qquad (4.23.2)$$

Equations (4.22) and (4.23) can be combined to give equation
(4.24).

$$(DT)_1 = (DT)_2 + (BPR)_2 - (BPR)_1 \qquad (4.24)$$

Since this relationship between $(DT)_1$ and $(DT)_2$ is
always valid, the calculation procedure giving temperature
distribution is modified accordingly. The first body is
excluded from the set of equations (4.5) and (4.6) and expressed
by equations (4.25) and (4.26).

$$\sum_{i=2}^{n} (DT)_i = (TS) - (TC)_{n+1} - (TBPR) \qquad (4.25)$$

where $(TBPR) = \sum_{i=2}^{n} (BPR)_i$

$$[\frac{U_i(DT)_i}{Q_i} - \frac{1}{R_i} \frac{U_{i+1}(DT)_{i+1}}{Q_{i+1}}] = 0 \qquad (4.26)$$

$$[i=2 \text{ to } (n-1)]$$

Solution of (n-1) equations (4.25) and (4.26) will give the (n-1) temperature drops $(DT)_i$ for bodies 2 to n and $(DT)_1$ can be calculated by equation (4.24).

Changes in material balances are expressed by equation (4.25)

$$(LO)_7 = (FF)_1 - V_7 \qquad (4.25.1)$$

$$(LO)_6 = (FF)_2 - V_6 \qquad (4.25.2)$$

$$(LO)_5 = (LF) - V_5 - V_6 - V_7 \qquad (4.25.3)$$

$$(LO)_4 = (LF) - V_4 - V_5 - V_6 - V_7 \qquad (4.25.4)$$

$$(LO)_3 = (LF) - V_3 - V_4 - V_5 - V_6 - V_7 \qquad (4.25.5)$$

$$(LO)_2 = (LF) - V_2 - V_3 - V_4 - V_5 - V_6 - V_7 \qquad (4.25.6)$$

$$(LO)_1 = (LF) - V_1 - V_2 - V_3 - V_4 - V_5 - V_6 - V_7 \qquad (4.25.7)$$

Material balance equations (4.10) and (4.11) for LFT and CFT and CFT remain unaltered. Revision of heat balance equations (4.12) result in equations (4.26).

$$S_1[(HS)-(HC)_1] - V_1(HV)_1 = (LO)_1(HLO)_1 - (LO)_2(HLI)_1 \qquad (4.26.1)$$

$$S_2[(HS)-(HC)_2] - V_2(HV)_2 = (LO)_2(HLO)_2 - (LO)_3(HLI)_2 \qquad (4.26.2)$$

$$V_1[(HV)_1-(HC)_3]+V_2[(HV)_2-(HC)_3] + (VCFT)_1[(HVCFT)_1-(HC)_3]$$

$$-V_3(HV)_3 = (LO)_3(HLO)_3-(LO)_4(HLI)_3 \qquad (4.26.3)$$

$$[V_1+V_2+(VCFT)_1][(HC)_3-(HC)_4] + V_3[(HV)_3-(HC)_4]+(VLFT)_1[(HVLFT)_1$$
$$-(HC)_4] + (VCFT)_2[(HVCFT)_2-(HC)_4] - V_4(HV)_4=(LO)_4(HLO)_4$$
$$-(LO)_5(HLI)_4 \qquad (4.26.4)$$

$$[V_1+V_2+V_3+(VLFT)_1 + (VCFT)_1 + (VCFT)_2] [(HC)_4-(HC)_5] + V_4[(HV)_4$$
$$-(HC)_5] - V_5(HV)_5 = (LO)_5(HLO)_5-[(LO)_6+(LO)_7](HLI)_5$$
$$(4.26.5)$$

$$[V_1+V_2+V_3+V_4+(VLFT)_1+(VCFT)_1+(VCFT)_2][(HC)_5-(HC)_6] + V_5[(HV)_5$$
$$-(HC)_6] - V_6(HV)_6 = (LO)_6(HLO)_6 - (FF)_2(HLI)_6 \qquad (4.26.6)$$

$$[V_1+V_2+V_3+V_4+V_5+(VLFT)_1+(VCFT)_1+(VCFT)_2][(HC)_6-(HC)_7]$$
$$+V_6[(HV)_6-(HC)_7] - V_7(HV)_7 = (LO)_7(HLO)_7-(FF)_1(HLI)_7$$
$$(4.26.7)$$

Energy balance equations (4.13) and (4.14) for LFT and CFT remain unchanged. Equation (4.27) gives the overal material balance.

$$\sum_{i=1}^{n} V_i + (VLFT)_1 = (LF) - (LP) \qquad (4.27)$$

Thus set of equations (4.13), (4.26) and (4.27) consist of nine independent equations with ten unknown terms - V_i, $(VLFT)_1$, S_1 and S_2. One of these unknowns can be expressed in terms of one of the other unknown. For example, relation (4.28) can be assumed between V_1 and V_2.

$$V_1 - V_2 = (VDIFF) \qquad (4.28)$$

In the first iteration, the evaporation in each effect is assumed to be equal and evaporation in LFT to be 1.0 per cent of total evaporation in the system. Therefore, for these initial values of evaporation the following relation can be written

$$(V_1 + V_2) = V_3 = V_4 = V_5 = V_6 = V_7 = \frac{0.99[(LF) - (LP)]}{N}$$

$$(4.29)$$

Values of V_1 and V_2 can be initialized based on the ratio of 1st body to 2nd body (RAB1) (which is generally equal to one) and then equation (4.28) gives the value of (VDIFF).

$$V_1 = \frac{(RAB1)}{[1 + (RAB1)]} V_3 \qquad (4.30.1)$$

$$V_2 = \frac{1}{[1 + (RAB1)]} V_3 \qquad (4.30.2)$$

On substitution of V_1 in terms of V_2 by equation (4.28) in equations (4.26.3) to (4.26.7) and (4.27), these equations along with equation (4.13) form a set of 7 independent equations and their solution will provide the values of 7 unknowns — V_2 to V_7 and $(VLFT)_2$. V_1 can then be evaluated from equation (4.28).

Equations (4.31) representing heat transfer in first two bodies are used to calculate the steam consumption using

equations (4.32) and (4.33) which will satisfy the constraint on the areas of the first two bodies.

$$Q_1 = V_1(HV)_1 + (LO)_1(HLO)_1 - (LO)_2(HLI)_1 \qquad (4.31.1)$$

$$Q_2 = V_2(HV)_2 + (LO)_2(HLO)_2 - (LO)_3(HLI)_2 \qquad (4.31.2)$$

$$(AAV) = \frac{1}{2} \left[\frac{Q_1}{U_1(DT)_1} + \frac{Q_2(RAB1)}{U_2(DT)_2} \right] \qquad (4.32)$$

$$S_1 = \frac{(AAV)\,U_1(DT)_1}{[(HS) - (HC)_1]} \qquad (4.33.1)$$

$$S_2 = \frac{(AAV)\,U_2(DT)_2}{(RAB1)[(HS)-(HC)_2]} \qquad (4.33.2)$$

$$S = S_1 + S_2 \qquad (4.33.3)$$

Heat transfer in other bodies are calculated from expressions similar to equations (4.19).

The values of (VDIFF) for the subsequent iterations is given by the difference in the values of V_1 and V_2 based on equations (4.34)

$$V_1 = \frac{(LO)_2(HLI)_1-(LO)_1(HLO)_1+S_1[(HS)-(HC)_1]}{(HV)_1} \qquad (4.34.1)$$

$$V_2 = \frac{(LO)_3(HLI)_2-(LO)_2(HLO)_2+S_2[(HS)-(HC)_2]}{(HV)_2} \qquad (4.34.2)$$

4.2.3 Integral Heaters:

The incorporation of integral heaters is done in backward feed flow arrangement to decrease the nonboiling

zone otherwise needed in the bodies. The model assumes that integral heaters are not present with forward flow liquor pattern. Figure (4.4) shows the evaporation plant of Fig. (4.3) with the addition of integral heaters. The temperature of exit liquor from integral heaters can be estimated for specified area or temperature differential approach. The former assumes that IH area equals a fraction (RIH), [normally 0.08 - 0.12] of the area of the corresponding body and the latter assumes a temperature rise in the heater equal to ratio (RIH1) [70-80 per cent] of the available temperature potential.

4.2.3.1 Integral Heaters of Specified Area:

The area of heat transfer in IH is specified as a fraction (RIH) of area of corresponding body.

$$(AIH)_i = (RIH) \ A_i \qquad (4.35)$$

$$(i = 3 \text{ to } 7)$$

Changes in liquor temperature across each IH is determined from energy balance and rate expressions. The rate expressions for each IH can be given by equation (4.36)

$$(QIH)_i = (UIH)_i (AIH)_i \ [(TC)_i - [\frac{(TIHI)_i - (TIHO)_i}{2}]]$$

$$(4.36)$$

For the plant shown in Figure (4.4), the inlet temperature to each IH is the exit liquor temperature of the
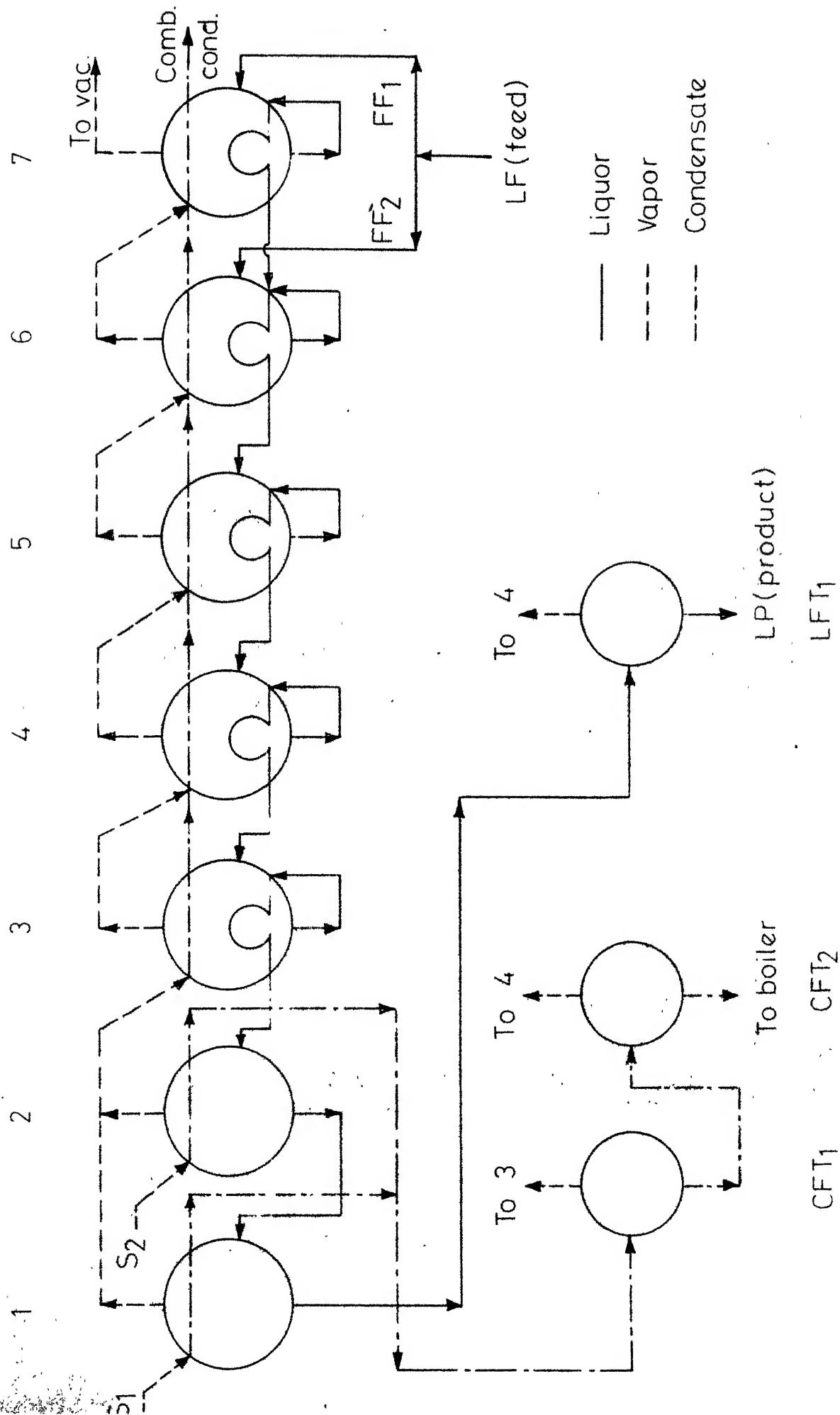
Fig 4.4 – Sextuple effect seven body evaporation plant with LFT, CFT, IH (Plant-14).

49

corresponding body except IH in body 6. Since the feed to $(IH)_6$ is the exit liquors of 6th body and $(IH)_7$, the inlet temperature to $(IH)_6$ is calculated from following equation (4.37).

$$(TIHI)_6 = \frac{(LO)_6(SPHT)_6(TO)_6 + (LO)_7(SPHT)_7(TIHO)_7}{0.5[(LO)_6 + (LO)_7][(SPHT)_6 + (SPHT)_7]}$$

$$(4.37)$$

Equations (4.38) represent amounts of heat transferred and equations (4.39) derived from equations (4.35) and (4.38) give outlet temperatures of each IH except $(IH)_6$ and equations (4.40) and (4.41) evaluate, those for $(IH)_6$ with the assumption that the combined liquor $[(LO)_6 + (LO)_7]$ has specific heat equal to that of $(LO)_6$.

$$(QIH)_i = (LO)_i (SPHT)_i [(TIHI)_i - (TIHO)_i] \qquad (4.38)$$

$$(TIHO)_i = \frac{(UIH)_i(AIH)_i[(TC)_i - 0.5(TIHI)_i] + (LO)_i(SPHT)_i(TIHI)_i}{(LO)_i(SPHT)_i + 0.5(UIH)_i(AIH)_i}$$

$$(4.39)$$

$$(i = 3,4,5,7)$$

$$(QIH)_6 = [(LO)_6 + (LO)_7](SPHT)_6[(TIHO)_6 - (TIHI)_6]$$

$$(4.40)$$

$$(TIHO)_6 = \frac{(UIH)_6(AIH)_6[(TC)_6 - 0.5(TIHI)_6] + [(LO)_6 + (LO)_7](SPHT)_6(TIH)}{[(LO)_6 + (LO)_7](SPHT)_6 + 0.5(UIH)_6(AIH)_6}$$

$$(4.41)$$

For the initialization of the iterative design calculations, temperature increase in IH is assumed to bring the

liquor to the boiling temperature corresponding to the body where the preheated liquor is introduced. This is represented by equation (4.42)

$$(TIHO)_i = (TO)_{i-1} \qquad (4.42)$$
$$(i = 3 \text{ to } 7)$$

An additional term is included in energy balance equations (4.26) to account for the heat transfer in the integral heaters.

4.2.3.2 <u>Integral Heaters with Specified Temperature Differential</u>

The heat transfer area for the IH is calculated on the basis of an assumed temperature differential across the IH as represented by equation (4.43)

$$(RIH1) = \frac{(TIHO)_i - (TIHI)_i}{(TC)_i - (TIHI)_i} \qquad (4.43)$$
$$(i = 3 \text{ to } 7)$$

The inlet temperature to each IH is estimated as described in preceding section. Exit liquor temperatures from each IH are given by equation (4.44) obtained by rearranging equation (4.43)

$$(TIHO)_i = (TC)_i - [1 - (RIH1)] \; [(TC)_i - (TIHI)_i] \qquad (4.44)$$
$$(i = 3 \text{ to } 7)$$

With this method, there is no need of initialization of temperatures. Equations (4.38) and (4.40) give $(QIH)_i$ and equations (4.36) are utilized for computing the areas of the integral heaters.

4.2.4 Finisher Effect:

Figure (4.5) represents a sextuple effect-seven body evaporation plant with 5 integral heaters, one LFT, 2 CFT and one finisher effect with 2 FCFT.

Material balances for all the bodies and CFT remain same as equations (4.25) and (4.11) and those for finisher LFT and FCFT are given by equations (4.45), (4.46) and (4.47).

$$(LFINO) = (LO)_1 - (VFIN) \qquad (4.45)$$

$$(LLFTO)_1 = (LFINO) - (VLFT)_1 \qquad (4.46)$$

$$(CFCFTO)_b = (SFIN) - (VFCFT)_1 \qquad (4.47.1)$$

$$(CFCFTO)_2 = (CFCFTO)_1 - (VFCFT)_2 \qquad (4.47.2)$$

The heat balance equations (4.26.1) and (4.26.2) for first two bodies also remain unchanged but the other equations (4.26.3) to (4.26.7) are modified to set of equations (4.48) where V_1 is expressed in terms of V_2.

$$[(HV)_1 + (HV)_2 - 2(HC)_3]V_2 + (VDIFF)[(HV)_1 - (HC)_3] + (VCFT)_1[(HVCFT)_1$$

$$-(HC)_3] + (VFCFT)_1[(HVFCFT)_1 - (HC)_3] - V_3(HV)_3$$

$$= (LO)_3(HLO)_3 - (LO)_4(HLI)_3 \qquad (4.48.1)$$
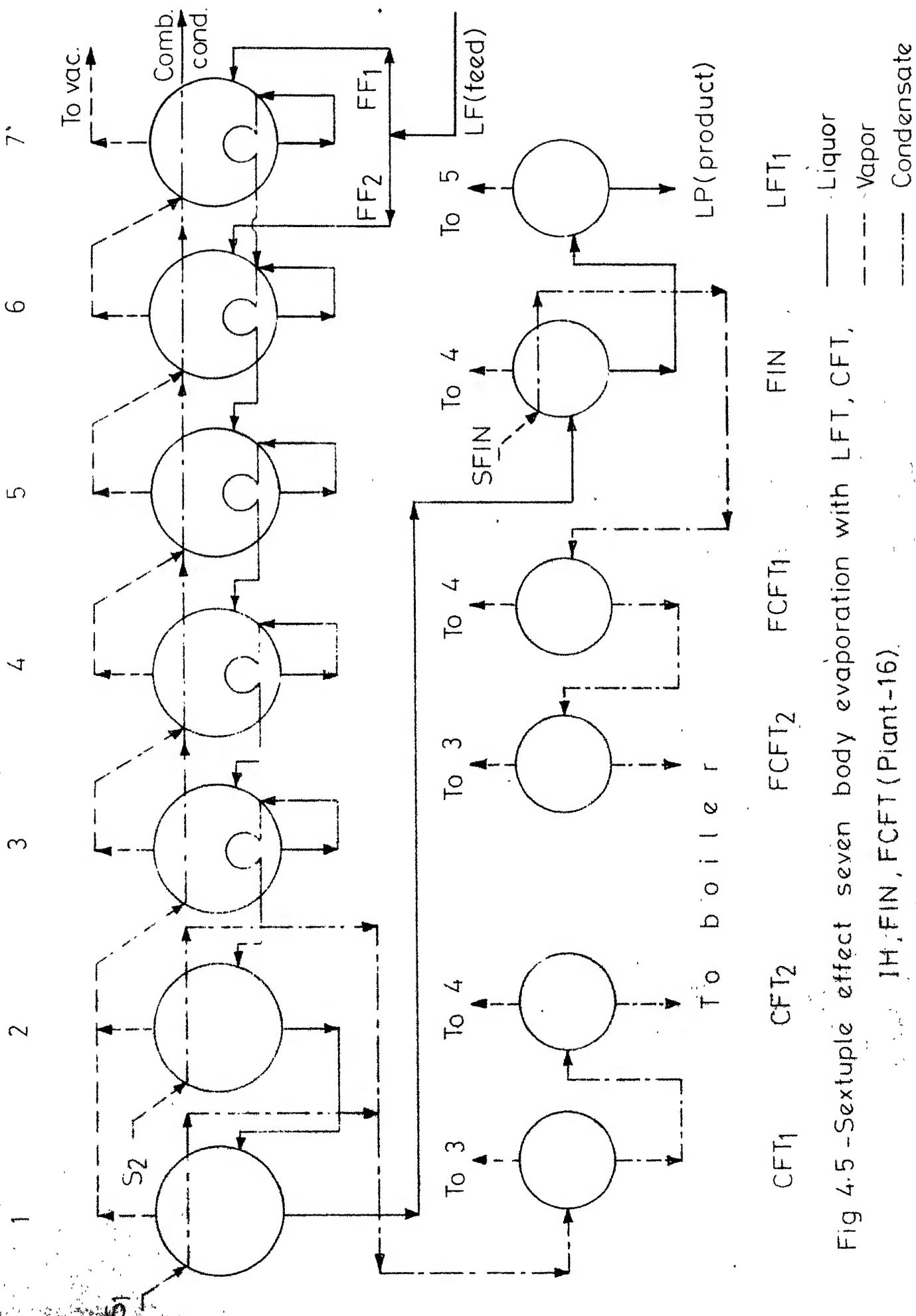
Fig 4.5 -Sextuple effect seven body evaporation with LFT, CFT,

IH, FIN, FCFT (Plant-16).

53

$$[2V_2+(VDIFF) + (VCFT)_1 + (VFCFT)_1][(HC)_3-(HC)_4] + V_3[(HV)_3-(HC)_4]$$

$$+ (VFIN)[(HVFIN)-(HC)_4]+(VCFT)_2[(HVCFT)_2-(HC)_4]$$

$$+ (VFCFT)_2[(HVFCFT)_2-(HC)_4] - V_4(HV)_4 = (LO)_4(HLO)_4-(LO)_5(HLI)_4$$

$$(4.48.2)$$

$$[2V_2+V_3+(VDIFF) + (VFIN) + (VCFT)_1 + (VCFT)_2+ (VFCFT)_1+(VFCFT)_2]$$

$$[(HC)_4-(HC)_5] + V_4[(HV)_4-(HC)_5] + (VLFT)_1[(HVLFT)_1-(HC)_5]$$

$$- V_5(HV)_5 = (LO)_5(HLO)_5 - [(LO)_6 + (LO)_7](HLI)_5$$

$$(4.48.3)$$

$$[2V_2+V_3+V_4+(VDIFF) + (VFIN)+(VLFT)_1+(VCFT)_1+(VCFT)_2+(VFCFT)_1$$

$$+(VFCFT)_2][(HC)_5-(HC)_6]+V_5[(HV)_5-(HC)_6]-V_6(HV)_6$$

$$= (LO)_6(HLO)_6-(FF)_2(HLI)_6 \qquad (4.48.4)$$

$$[2V_2+V_3+V_4+V_5+(VDIFF)+(VFIN)+(VLFT)_1+(VCFT)_1+(VCFT)_2+(VFCFT)_1$$

$$+(VFCFT)_2][(HC)_6-(HC)_7] + V_6[(HV)_6-(HC)_7] - V_7(HV)_7$$

$$= (LO)_7(HLO)_7 - (FF)_1(HLI)_7 \qquad (4.48.5)$$

Equations (4.49) and (4.50) give the energy balances for the finisher and LFT.

$$(VFIN)(HVFIN) = (LO)_1(HLO)_1 - (LFINO)(HLFINO)$$
$$+ (SFIN)[(HSFIN) - (HCFIN)] \qquad (4.49)$$

$$(VLFT)_1(HVLFT)_1 = (LFINO) (HLFINO) - (LLFTO)_1(HLLFTO)_1$$
$$(4.50)$$

The heat balance equations for CFT are given by equations (4.14) and equations (4.51) for FCFT.

$$(VFCFT)_1 (HVFCFT)_1 = (SFIN)(HCFIN) - (CFCFTO)_1 (HCFFTO)_1$$

$$(4.51.1)$$

$$(VFCFT)_2 (HVFCFT)_2 = (CFCFTO)_1 (HCFFTO)_1 - (CFCFTO)_2 (HCFFTO)_2$$

$$(4.51.2)$$

Overall material balance for the system can be written as equation (4.52)

$$2V_2 + (VDIFF) + \sum_{i=3}^{N} V_i + (VLFT)_1 + (VFIN) = (LF) - (LP)$$

$$(4.52)$$

For the first iteration evaporation in finisher is assumed to be 5 per cent of the total evaporation and the steam required for finisher is calculated from equation (4.53).

$$(SFIN) = \frac{(VFIN)(HVFIN) + (LFINO)(HLFINO) - (LO)_1 (HLO)_1}{[(HSFIN) - (HCFIN)]}$$

$$(4.53)$$

The eight independent equations (4.48), (4.49), (4.50) and (4.52) can be solved for the eight unknowns V_2 to V_7, $(VLFT)_1$ and (VFIN). Equations (4.18) and (4.51) give vapor flow rates from CFT and FCFT respectively.

Heat transfer rate in finisher can be computed from equation (4.54)

$$(QFIN) = (VFIN)(HVFIN) + (LFINO)(HLFINO) - (LO)_1 (HLO)_1$$

$$(4.54)$$

The value of the heating surface area of the finisher can be calculated from finisher capacity equation (4.55)

$$(QFIN) = (UFIN) (AFIN) (DTFIN) \qquad (4.55)$$

4.2.5 Multiple Feed:

Figure (4.6) represents the plant shown in Figure (4.3) fed with a single feed stream to sixth body along with a multiple feed stream to seventh body, and Fig. (4.7) represents the plant of Fig. (4.5) with a multiple feed stream to fifth body along with the parallel feed to sixth and seventh bodies. For illustration purposes the plant of Fig. (4.7) will be considered.

In general, the total multiple-feed (TMF) can be given by equation (4.56).

$$(TMF) = \sum_{i=1}^{n} (MF)_i \qquad (4.56)$$

The feed through the single or parallel feed streams (FPS) is given by equation (4.57).

$$(FPS) = (LF) - (TMF) \qquad (4.57)$$

The enthalpies of multiple feed streams has to be accounted properly in enthalpy balance equations of the bodies.

For the plant of Fig. (4.7), (FPS) is sum of two feed streams fed in parallel to 6th and 7th body.
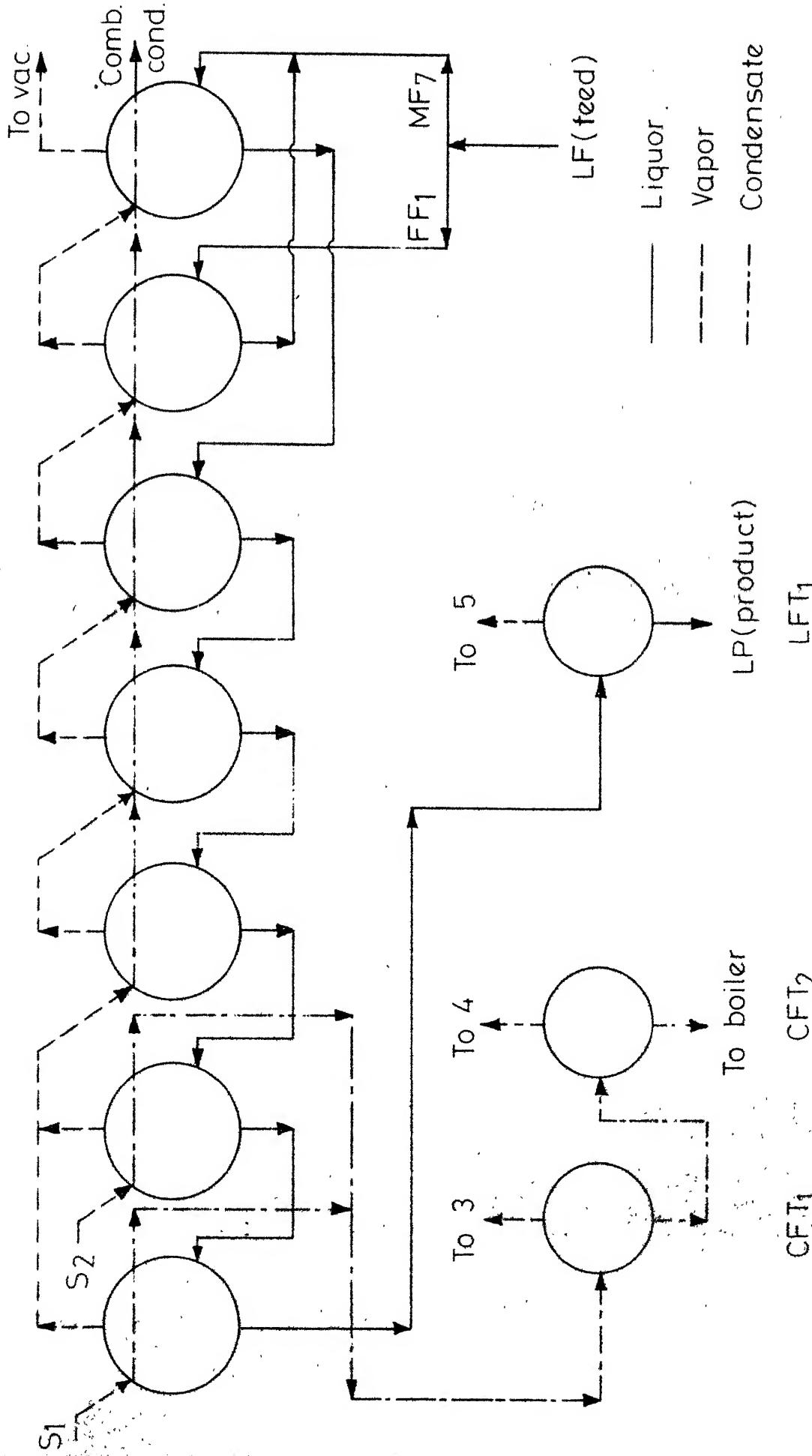
Fig. 4.6. -Sextuple effect seven body evaporation plant with LFT, CFT (Plant-13).

Liquor ———
Vapor —— ——
Condensate —·—·—

LF (feed)

Comb. cond.

To vac.

MF₇

FF₁

S₁

S₂

LP (product)

LFT₁

To 5

CFT₂

To boiler

To 4

CFT₁

To 3

Fig. 4.7 - Sextuple effect seven body evaporation plant with LFT, CFT, IH, FIN, FCFT (Plant - 17)
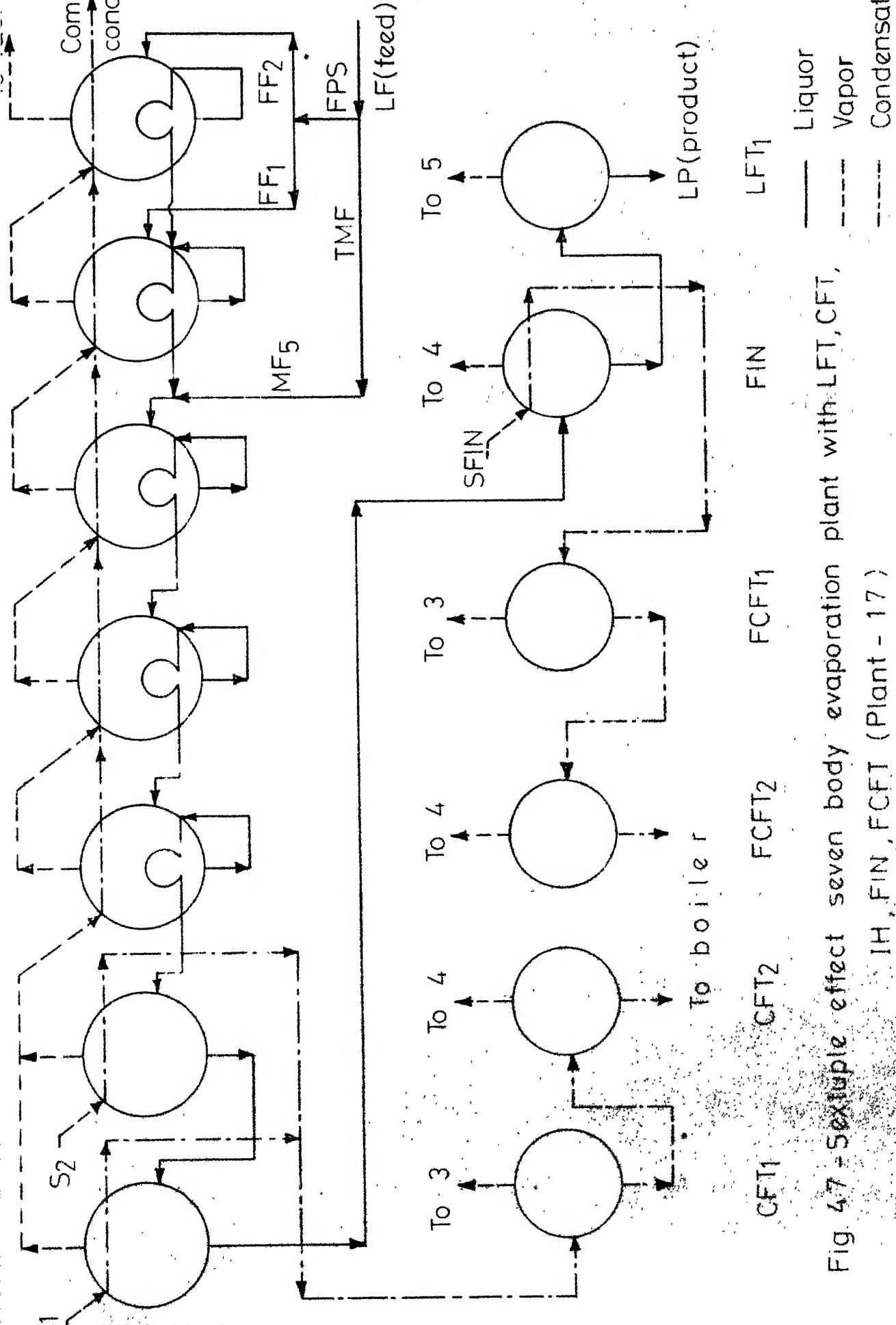
Liquor
Vapor
Condensate

$$(FPS) = (FF)_1 + (FF)_2 \qquad (4.58)$$

Only equation (4.48.3) representing energy balance of 5th body gets modified to (4.59).

$$[2V_2+V_3+(VDIFF)+(VFIN)+(VCFI)_1+(VCFT)_2+(VFCFT)_1+(VFCFT)_2]$$
$$[(HC)_4-(HC)_5] + V_4[(HV)_4-(HC)_5] + (VLFT)_1[(HVLFT)_1-(HC)_5]$$
$$-V_6(HV)_5 = (LO)_5(HLO)_5-[(LO)_6+(LO)_7](HLI)_5-(MF)_5(MMF)$$
$$(4.59)$$

4.2.6 Vapor Bleed Streams:

Vapor from any effect can be partially withdrawn from the system as a bleed stream for either preheating of a liquor stream or elsewhere in the plant where low pressure steam is needed.

4.2.6.1 Vapor Bleed Streams in Sextuple Effect-Six Body Evaporation Plant:

The plant shown in Fig. (4.1) with vapor bleed stream only from first body is considered for illustration purposes. The amount of vapor bleed will depend upon the heat duty of the specific requirement/application.

$$(VB)_i = \frac{(QB)_i}{[(HC)_i - (HC)_{i+1}]} \qquad (4.60)$$

Withdrawal of bleed steam from any body decreases the quantity of vapor for the subsequent steam chest $[V_i-(VB)_i]$

and can be suitably included in the energy balance.

For the plant considered, the energy balance equation (4.12.2) for second body gives equation (4.61) on inclusion of term for vapor bleed.

$$[V_1-(VB)_1][(HV)_1-(HC)_1] + (VCFT)_1[(HVCFT)_1-(HC)_2]$$
$$-V_2(HV)_2 = (LO)_2(HLO)_2-(LO)_3(HLI)_2 \qquad (4.61)$$

Bleed steam condensate can be either drained or returned to the evaporation plant condensate system for heat recovery. In the former method, V_1 is replaced by $[V_1-(VB)_1]$ in the enthalpy balances for subsequent bodies whereas for the latter case they remain unaltered. Similar modifications are necessary in the heat transfer rate expressions (4.19).

4.2.6.2 Vapor Bleed Streams in Sextuple-Effect-Seven Body Evaporation Plant:

Figure (4.8) represents the sextuple effect-seven-body evaporation plant shown in Fig. (4.7) with vapor bleed streams from first and second effects. The first effect has two bodies with common vapor line to subsequent effect and V_1 is represented in terms of V_2 from equation (4.28) in different equations. So $(VB)_1$ is assigned a value zero and $(VB)_2$ represents the amount of vapor bled from first effect.

$$(VB)_2 = \frac{(QB)_1 + (QB)_2}{[(HV)_2-(HC)_3]} \qquad (4.62)$$
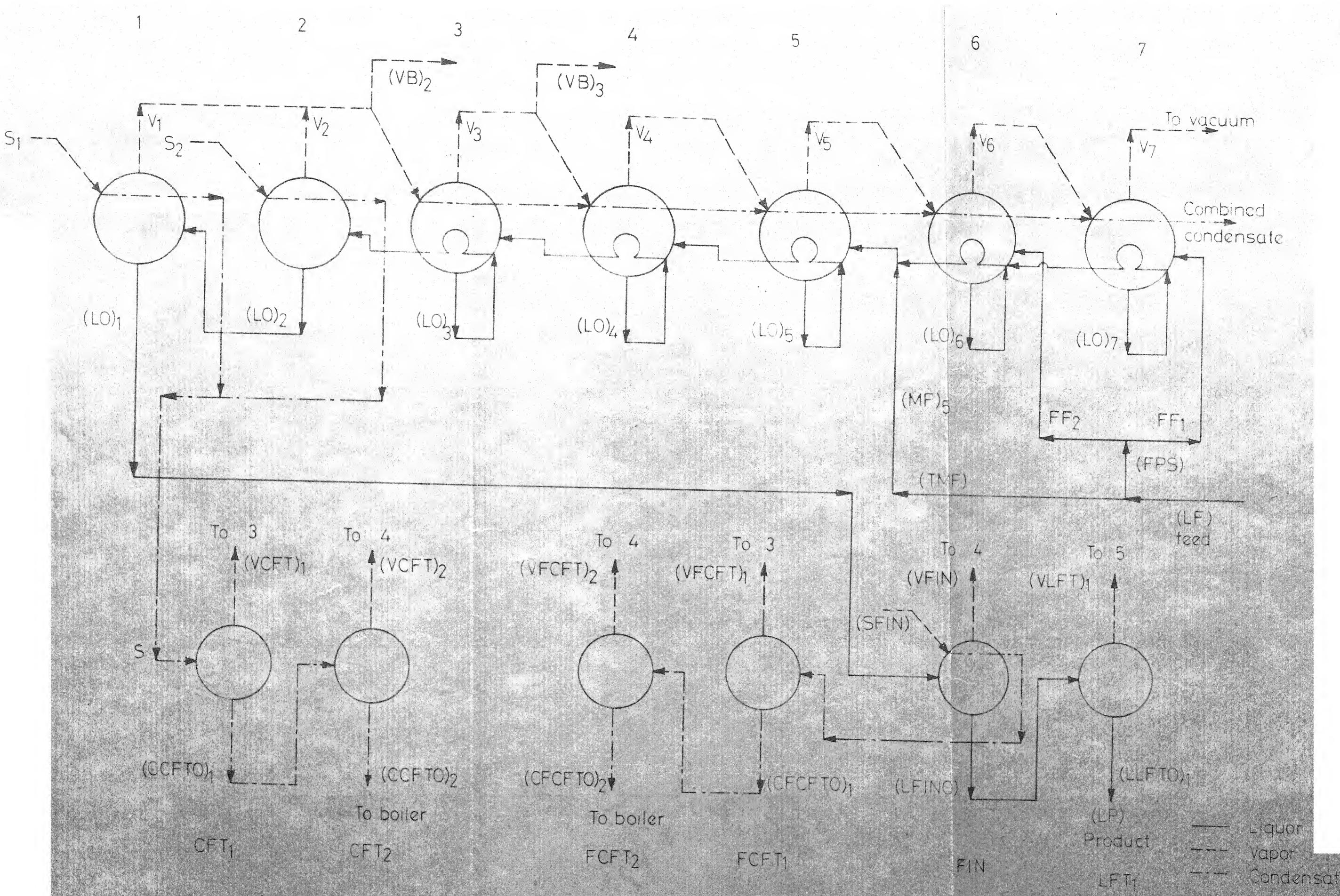
Fig 4.8 – Sextuple effect seven body evaporation plant with LFT, CFT, IH, FIN, FCFT, VBP (Plant –18).

When the bleed steam condensate is not returned to the plant for heat recovery, the enthalpy balance equations (4.48.1) and (4.48.2) for 3rd and 4th body are modified to equations (4.63).

$$[(HV)_1 + (HV)_2 - 2(HC)_3] \, V_2 - (VB)_2 \, [(HV)_2-(HC)_3]$$

$$+(VDIFF)[(HV)_1 - (HC)_3] + (VCFT)_1[(HVCFT)_1-(HC)_3]$$

$$+(VFCFT)_1[(HVFCFT)_1 - (HC)_3] - V_3(HV)_3$$

$$= (LO)_3(HLO)_3 - (LO)_4(HLI)_3 \qquad (4.63.1)$$

$$[2V_2-(VB)_2+(VDIFF) + (VCFT)_1+(VFCFT)_1][(HC)_3-(HC)_4]$$

$$+[V_3-(VB)_3][(HV)_3-(HC)_4] + (VFIN)[(HVFIN)-(HC)_4]$$

$$+(VCFT)_2[(HVCFT)_2-(HC)_4] + (VFCFT)_2[(HVFCFT)_2-(HC)_4]$$

$$-V_4(HV)_4 = (LO)_4(HLO)_4-(LO)_5(HLI)_4 \qquad (4.63.2)$$

Similarly the enthalpy balance expressions (4.48.3) to (4.48.5) of subsequent bodies and expressions for rate of heat transfer are modified.

4.2.7 Radiation Loss:

Radiation heat losses from the evaporation plant can be either accounted for in the energy balance equation for each effect or more conveniently lumped together as a radiation loss factor (RL) in the steam heat input to the system. For plant shown in Fig. (4.3) equations (4.64) and (4.65) including

the heat loss terms are derived from equations (4.26.1),
(4.26.2), (4.33.1) and (4.33.2)

$$S_1[(HS)-(HC)_1][1-(RL)] - V_1(HV)_1 = (LO)_1(HLO)_1-(LO)_2(HLI)_1$$

$$(4.64.1)$$

$$S_2[(HS) - (HC)_2][1-(RL)] - V_2(HV)_2 = (LO)_2(HLO)_2-(LO)_3(HLI)_2$$

$$(4.64.2)$$

$$S_1 = \frac{(AAV) \ U_1 (DT)_1}{[(HS)-(HC)_1][1-(RL)]} \qquad (4.65.1)$$

$$S_2 = \frac{(AAV)}{(RAB1)} \ \frac{U_2(DT)_2}{[(HS)-(HC)_2][1-(RL)]} \qquad (4.65.2)$$

Similarly equations (4.34) derived from equations (4.26.1) and
(4.26.2) will also be changed to account for (RL).

Heat losses in finisher system can either be accounted
in the factor (RL) in the steam heat input to first effect
or by a factor (RLF) in the finisher steam heat input.
Equation (4.66) is the modified form of equation (4.49)
including the factor (RLF) for the plant of Fig. (4.8).

$$(VFIN)(HVFIN) = (LO)_1(HLO)_1 - (LFINO)(HLFINO) + (SFIN)[(HSFIN)$$
$$-(HCFIN)][1-(RLF)] \qquad (4.66)$$

Similarly equation (4.53) for computing steam
requirement of finisher also will be modified as it is derived
from equation (4.49).

The discussions so far dealt with several possible
process modifications to a relatively simple case of a

sextuple-effect evaporation plant. This analysis can be generalized for any evaporation plant by using different arrays specifying flow order of vapor and liquor steams, and disposition of various effects and auxiliary units in the evaporation plant. This is discussed later in section 4.4 dealing with the computer program MEEDS.

4.3 Simulation:

Simulation studies of evaporation plant can be carried out using observed plant data. Quite often plant observations recorded in daily logsheets will have the following data-feed, product, steam and cooling water flow rates, temperatures of liquor streams pressures in calendria and top separator, of the effects and concentrations of feed, product and at times some of the intermediate streams. The problem is then to determine U-values for the different effects utilizing some of the above data like feed rate, temperature of liquor streams, pressures in calendria and top separator of the effects and concentrations of feed, product and some/none of the interstreams. Sometimes it is necessary to predict the influence of certain variables on the performance of an existing evaporation plant processing a liquor of known physico-chemical properties. These variables can include a change in steam pressure, feed conditions (temperature, concentration and rate) product concentration or vacuum on the system. In simulation

studies the plant performance can also be predicted when one
of the effects is bypassed for maintenance purposes. Simulation
studies can also be used to recommend modification to existing
evaporation plants for improving the performance and steam
economy.

The mathematical formulation derived earlier for
design calculations are also applicable for simulation analysis.

4.4 Computer Program:

A computer program 'MEEDS' is developed for design/
simulation of a general multiple effect evaporation plant.
The program can handle any plant having the following features -
n-effects, LFT, CFT, IH,FIN,FCFT and VBP and also allow for
thermal radiation losses, effect of BPR, two tube pass arrange-
ment in the first effect and various liquor feed flow arrange-
ments.

The program MEEDS written in FORTRAN IV for use on
IBM-7044 can also be used readily on IBM-370. The program
is based on the calculation model discussed earlier in this
Chapter. A number of different counters and arrays are used
in the program to provide the necessary flexibilities in the
evaporation plant. These features greatly enhance the versati-
lity of the program for solving several complex evaporation
plants. SI units are used for the different variables in the

process engineering calculations. The program listing is given in Appendix C.

This section discusses the following aspects of the MEEDS program:

1. Counters and arrays used for defining plant configurations, vapor and liquid flow orders and problem objectives (design/simulation).

2. Subroutines or function subprograms for liquor and vapor characteristics and process engineering calculations.

3. List of assumptions

4. List of necessary input data

5. Program operation

6. Flow chart for the program

7. Program output.

4.4.1 Counters:

The different counters used to define the problem precisely are summarized in Table (4.2).

4.4.2 Arrays:

A number of arrays are used in the program MEEDS for different purposes like specification of liquor flow pattern, arrangement of auxiliary units like integral heaters and vapor flow from LFT, CFT and FCFT.

TABLE 4.2: LIST OF COUNTERS USED IN PROGRAM 'MEEDS' FOR MULTIPLE EFFECT EVAPORATION PLANT

Counter	Value	Remark
DESIGN	1.0	Design problem
DESIGN	0.0	Simulation problem
ISIM	0	Simulation analysis with known A and (DT)
ISIM	1	Simulation analysis with known A and approximate U.
IAB1	0	Conventional single pass in first effect
IAB1	1	Two-tube pass in first effect
IFINI	1	Finisher effect
IFINI	0	No finisher effect
IPFS	1	Feed stream to a single body
IPFS	2	Parallel feed streams to two bodies
FCHEAT	0.0	Foul condensate not flashed for heat recovery
FCHEAT	1.0	Foul condensate flashed sequentially up to the last body
KALBPR	1	BPR calculated from subroutines
KALBPR	0	BPR as input data

Table 4.2 (contd)

COUNTER	VALUE	REMARK
IPROCH	1	Specified temperature differential approach for IH
IPROCH	0	Specified area approach for IH
IBLEED	1	Vapor bleed from system
IBLEED	0	No vapor bleed stream
ICBLED	0	Condensates of vapor bleed streams not returned to evaporation plant
ICBLED	1	Condensates of vapor bleed streams returned for heat recovery.

NORD array explains the liquor flow pattern. NORD(J)=M implies that body M is the Jth body to receive the solution to be evaporated.

IFSORD array represents the body numbers receiving fresh feed. IFSORD(J) = M indicates that body M is the Jth body receiving feed stream.

IFEED array specifies the sources of liquor feed for each body. IFEED(J) = M indicates that overflow from body M is fed to J except when M is greater than number of bodies n. When M equals (n+1), then this is the body receiving the fresh feed fractions through IFSORD array. When IPFS=2, M can be (n+3) which represents the case when the body receives exit liquors from both the bodies receiving fresh feed fractions through IFSORD array.

NLORD array describes the vapor flow arrangement from LFT. NLORD(J) = M points out that vapor from LFT J go to steam chest of body M.

NCORD array represents vapor flow arrangement from CFT. NCORD(J) = M states that the steam chest of body M is receiving the vapor from CFT J.

NFCORD array refers to vapor flow arrangement from FCFT with NFCORD(J) = M indicating vapor flow from FCFT J to the steam chest of body M.

IIH array is defined to specify the bodies having integral heaters. IIH(J)=1 or 0 shows the presence or absence of IH in body J.

The values of above arrays for some typical plants are shown in Table (4.3). Use of such arrays provide several flexibilities in the evaporation plant all of which can be handled by the program MEEDS.

4.4.3 Subroutines/Function Subprograms:

For development of computer program for evaporation plant calculations, different functions for calculations of enthalpies of each stream (vapor/liquor/condensate) and BPR of liquor streams are needed. Similarly for solution of simultaneous equations one of the different available methods is to be selected. A list of different subroutines/ function subprograms used in the program is given below and the details are included in Appendix B.

STEAMH is a function subprogram for the enthalpy of saturated steam in kJ/kg as a function of temperature.

CONDEN subprogram evaluates the enthalpy of condensate in kJ/kg as a function of temperature.

SPHTN, SPHT1 are subroutines for computing the values of specific heat of different liquor streams in kJ/kg K.

BPRN, BPR1 are subroutines for calculating the values of BPR in different liquor streams in ^{O}C.

MATINV subroutine evaluates the solution of simultaneous equations using Gauss Jordon method with maximum pivot strategy.

TABLE 4.3: LIST OF ARRAYS FOR VARIOUS TYPICAL PLANTS

S.No.	Evaporation plant	NORD	IFSORD	IFEED	NLORD
1	Fig. (4.1)	5 6 4 3 2 1	5	.2 3 4 6 7 5	3
2	Fig. (4.2)	6 5 4 3 2 1	6 5	2 3 4 9 7 7	3
3	Fig. (4.3)	7 6 5 4 3 2 1	7 6	2 3 4 5 10 8 8	4
4	Fig. (4.4)	7 6 5 4 3 2 1	7 6	2 3 4 5 10 8 8	4
5	Fig. (4.5)	7 6 5 4 3 2 1	7 6	2 3 4 5 10 8 8	5
6	Fig. (4.6)	6 7 5 4 3 2 1	6	2 3 4 5 7 8 6	5
7	Fig. (4.7)	7 6 5 4 3 2 1	7 6	2 3 4 5 10 8 8	5
8	Fig. (4.8)	7 6 5 4 3 2 1	7 6	2 3 4 5 10 8 8	5

Table 4.3 (contd)

S.No.	Evaporation plant	NCORD	NFCORD	IIH					
1	Fig. (4.1)	2 3	—	0	0	0	0	0	0
2	Fig. (4.2)	2 3	—	0	0	0	0	0	0
3	Fig. (4.3)	3 4	—	0	0	0	0	0	0
4	Fig. (4.4)	3 4	—	0	0	1	1	1	1
5	Fig. (4.5)	3 4	3 4	0	0	1	1	1	1
6	Fig. (4.6)	3 4	—	0	0	0	0	0	0
7	Fig. (4.7)	3 4	3 4	0	0	1	1	1	1
8	Fig. (4.8)	3 4	3 4	0	0	1	1	1	1

4.4.4 <u>Assumptions</u>:

A list of assumptions used for evaporation plant process calculations using the computer program MEEDS are summarised below:

1. Steam input to first effect and finisher effect is saturated.

2. Condensate leaving at the presence of the calendria of each body and finisher effect is saturated.

3. Integral heaters are not present with forward liquor flow pattern

4. The specific heat of saturated steam is 1.872 kJ/kg K (0.45 Btu/lb^{o}F)

5. Design value of overall heat transfer coefficient for each effect is independent of temperature, concentration and flow rate of liquor over the range of interest.

6. Entrainment losses and foam problems are negligible.

4.4.5 <u>Input Data</u>:

The following list gives the input data necessary for program operation. The list is a general one for handling both design and simulation problems. Data relating to auxiliary features like flash tanks vapor bleeding points,

integral heaters, and finisher effect can be specified according to plant requirements.

1. Number of effects, bodies, LFT, CFT and IH

2. Counters IAB1, IFINI, IPFS, DESIGN, FCHEAT, KALBPR and IBLEED

3. Temperatures (TS), (TF), $(TC)_n$ and radiation loss fraction (RL).

4. Arrays NORD, IFEED, IFSORD and IIH.

5. Feed and product concentration.

6. Flow rate of feed streams through IFSORD array $(FF)_i$.

7. Flow rate of multiple feed streams $(MF)_i$

8. Boiling point rises $(BPR)_i$

9. Counter ICBLED and heat duties $(QB)_i$.

10. Counter IPROCH and depending upon IPROCH, ratio (RIH) or (RIH1).

11. NLORD array and $(BPRLFT)_i$

12. NCORD array.

13. NFOR (number of LFT receiving liquor before finisher), NVORD (body number of whose steam chest vapors from finisher enter), number of FCFT, TSFIN (fresh steam temperature to finisher), factor (RLF) and NFCORD array.

14. If DESIGN = 1.0

(i) U_i and area ratios R_i

(ii) $(UIH)_i$

(iii) (UFIN)

15. If DESIGN = 0.0

(i) ISIM and A_i

(ii) $(AIH)_i$

(iii) (AFIN)

(iv) If ISIM=0, $(DT)_i$ and if IAB1 = 1, the intermediate liquor concentration of the two bodies of first effect.

(v) If ISIM=1, approximate U_i.

16. Maximum number of iterations allowed.

4.4.6 Program Operation:

For design calculations of the evaporation plant, the necessary input data are read at first and then the enthalpies of steam and condensate of first effect and finisher are computed utilizing the STEAMH and CONDEN function subprograms. Enthalpy of feed is determined using subroutine SPHT1.

For initialization of the iterative process, vaporisations in each LFT and FIN are assumed to represent 1 per cent and 5 per cent of total evaporation in the plant. respectively The balance of evaporator duty is assumed to be equally distributed among the other effects.

Flow rates and concentrations of all streams from each body, LFT and finisher effect are calculated using the

material balances. Boiling point rise in each unit is then computed through subroutine BPRN and BPR1.

For the first iteration, heat transfer in each body is initialized at 10,000 kW and values of (DT) are determined from rate expressions. The temperature of various streams are then obtained. Enthalpies of liquor streams are estimated using subroutine SPHTN and SPHT1. The enthalpies of vapor and condensate streams are computed using STEAMH and CONDEN function subprograms respectively.

The amount of vapor to be withdrawn as bleed stream is based on heat duty requirements. Then heat transfer rate and steam required in finisher are evaluated followed by estimation of amount of flashing taking place in each FCFT.

In the next step, the temperatures of incoming and outgoing liquor streams for each IH are estimated based on specified area/temperature potential approach. For the first iteration in the former approach, the IH exit liquor temperature is initilized to the boiling temperature of the body receiving the preheated liquor. Therefore, the heat transfer rates in the integral heaters are computed followed by the estimation of enthalpies of these preheated streams.

Next, simultaneous solution of enthalpy balance equations around each body, LFT and finisher effect including the various auxiliary units (IH, VBP, CFT and FCFT) gives the quantity of vapor leaving each body, LFT and FIN. Based

on these vaporisation rates, heat transfer rates are determined followed by estimation of steam requirement.

Thereafter, heat transfer surface requirement of each body, IH and FIN are computed from their respective capacity equation.

The above procedure is repeated with the revised estimates of the various parameters until the convergence criteria is satisfied; the absolute difference in the estimated vapor flow rates in successive iteration should be less than 1 kg/h. The program then calculates the steam economy and prints the output.

The program operation described above is modified for the case when first effect has two bodies. In this case, IAB1 becomes equal to 1. For the first iteration, the total evaporation in these two bodies of first effect is initialized equal to evaporation in any of the other effects; evaporation in these bodies are initialized according to their area ratio. The value of (VDIFF) is evaluated before solving the enthalpy balance expressions. While calculating the steam requirement of the plant, the individual steam requirement of each body of first effect are calculated. Thereafter, the corrected values of vapor flow rates from these two bodies are calculated to provide the value of (VDIFF) for the next iteration.

For the simulation calculations of the evaporation plant, the modifications to be done in the program depend upon value

of counter ISIM. When ISIM = 0 and IAB1 = 1, then the
material balance equations are modified in such a way, that the
program fixes the concentration of interstream of two bodies
of first effect. For ISIM = 0 case, the temperature distri-
bution is known and hence the portion of the program calculating
this is eliminated. Again for the case ISIM = 0 and IAB1=1,
the steam requirements of the bodies of first effect are
calculated by equation (4.67)

$$S_i = \frac{Q_i}{[HS-(HC)_i][1-(RL)]} \qquad (4.67)$$
$$(i=1,2)$$

Instead of heat transfer areas, heat transfer
coefficients of each body, IH and FIN are computed for simulation
studies.

4.4.7 Flow Chart:

A flow chart outlining the major steps in execution
of the computer program MEEDS for the evaporation plant is
given in Fig. (4.9).

4.4.8 Output:

Output from program execution lists the following
parameters for a general evaporation plant.

1. Number of effects, bodies, LFT, CFT and IH
2. Counters DESIGN, FCHEAT, IFINI, IBLEED, KALBPR
   and IPFS

FIG. 4.9: FLOW CHART FOR THE GENERAL COMPUTER
PROGRAM 'MEEDS' FOR MULTIPLE EFFECT
EVAPORATION PLANT

```
┌──────────┐
│  START   │
└──────────┘
     │
     ▼
┌─────────────────────────────────────────────────────┐
│              Read input data                        │
└─────────────────────────────────────────────────────┘
     │
     ▼
┌─────────────────────────────────────────────────────┐
│ Calculate enthalpies of feed streams and saturated  │
│ steam and condensate of first effect and finisher   │
└─────────────────────────────────────────────────────┘
     │
     ▼
┌─────────────────────────────────────────────────────┐
│  Initialize $V_i$, $(VLFT)_i$, $(VFIN)$ and $Q_i$   │
└─────────────────────────────────────────────────────┘
     │
     │──────────────────────────────────────────  (10)
     ▼
┌─────────────────────────────────────────────────────┐
│  Calculate flow rates and concentrations of all     │
│         streams from material balances              │
└─────────────────────────────────────────────────────┘
     │
     ▼
┌─────────────────────────────────────────────────────┐
│  If KALBPR=1, Cal.$(BPR)_i$ for each liquor         │
│                     stream                          │
└─────────────────────────────────────────────────────┘
     │
     ▼
┌─────────────────────────────────────────────────────┐
│  Except for simulation case ISIM=0,                 │
│          Evaluate $(DT)_i$                          │
└─────────────────────────────────────────────────────┘
     │
     ▼
┌─────────────────────────────────────────────────────┐
│  Calculate temperature and enthalpies of all        │
│   exit liquor, vapor and condensate streams         │
└─────────────────────────────────────────────────────┘
     │
     ▼
   (20)
```
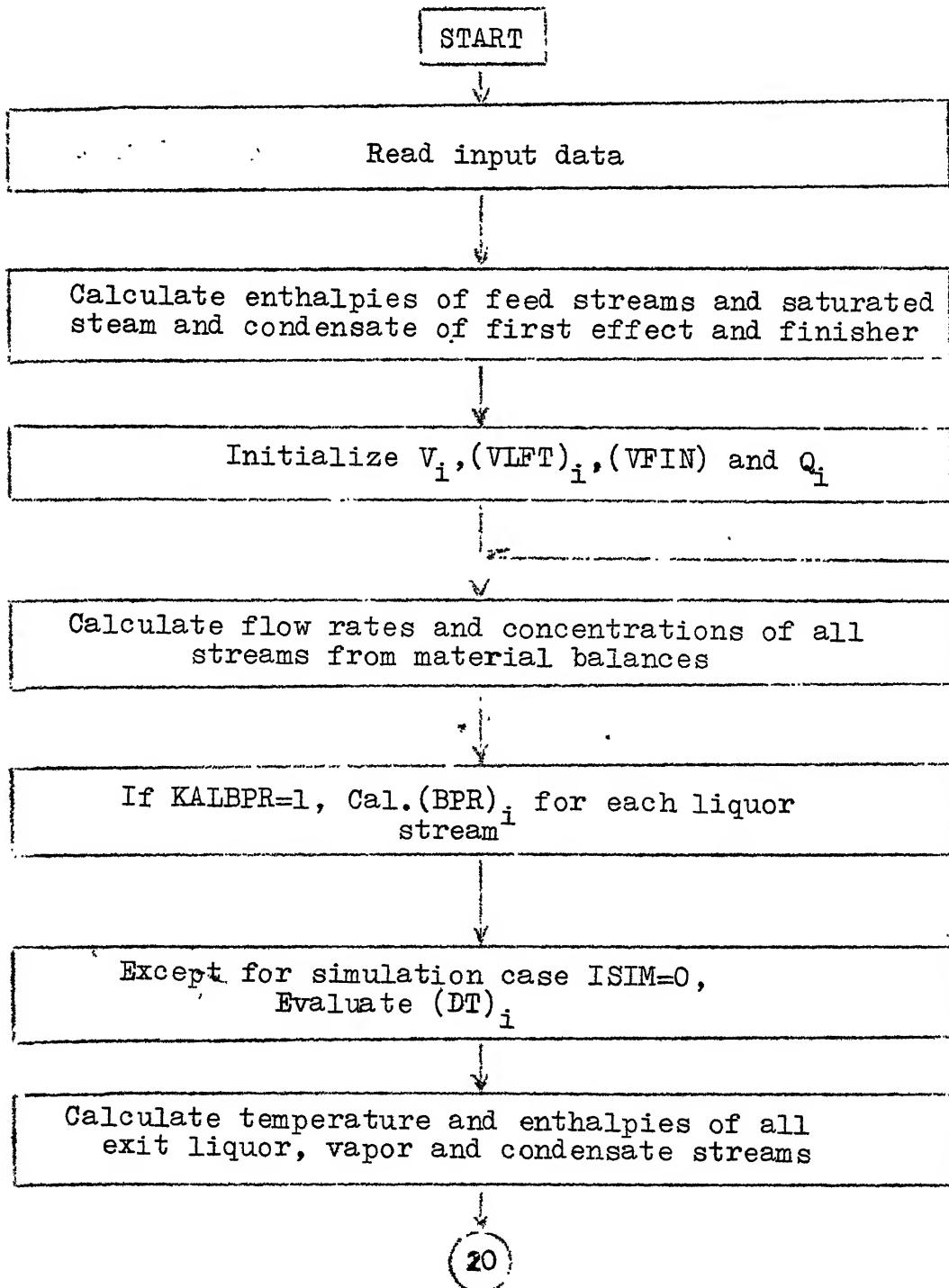
(20)

```
If IBLEED=1, Calculate (VB)_i
```

```
If IFINI=1, Calculate (QFIN) and (SFIN) and
    if FCFT are also present, Calculate(VFCFT)_i
```

```
If IH are present, calculate (TIHI)_i, (TIHO)_i
    and (QIH)_i according to the specified
    approach. In case of specified area
    approach, initialize (TIHO)_i for first
        iteration.
```

```
Estimate the temperature and enthalpies of
        liquor entering each body
```

```
If IAB1 = 1, Evaluate (VDIFF)
```

```
Establish the enthalpy balances for each body,
LFT and FIN and solve to give new V_i,(VLFT)_i
        and (VFIN).
```

```
Calculate Q_i and steam requirements
```

```
If CFT are present, calculate (VCFT)_i
```

(30)

```
                              ⎛30⎞
                               │
                               │
                               ▼
┌─────────────────────────────────────────────────────────────┐
│  If IAB1 = 1, correct the values of $V_1$ and $V_2$          │
│  from enthalpy balances to provide (VDIFF) for               │
│                   next iteration                             │
└─────────────────────────────────────────────────────────────┘
                               │
                               │
                               ▼
┌─────────────────────────────────────────────────────────────┐
│  For design, calculate $A_i$,(AIH)$_i$ and(AFIN) or          │
│  For simulation, calculate $U_i$, (UIH)$_i$ and              │
│                   (UFIN)                                      │
└─────────────────────────────────────────────────────────────┘
                               │
                               ▼
┌─────────────────────────────────────────────────────┐      NO  ⎛  ⎞
│        Is convergence criteria satisfied?            │- - - ->│10│
└─────────────────────────────────────────────────────┘          ⎝  ⎠
                               │
                              YES
                               │
                               ▼
┌─────────────────────────────────────────────────────┐
│       Compute steam economy and print results        │
└─────────────────────────────────────────────────────┘
                               │
                               ▼
                          ┌─────────┐
                          │  STOP   │
                          └─────────┘
```
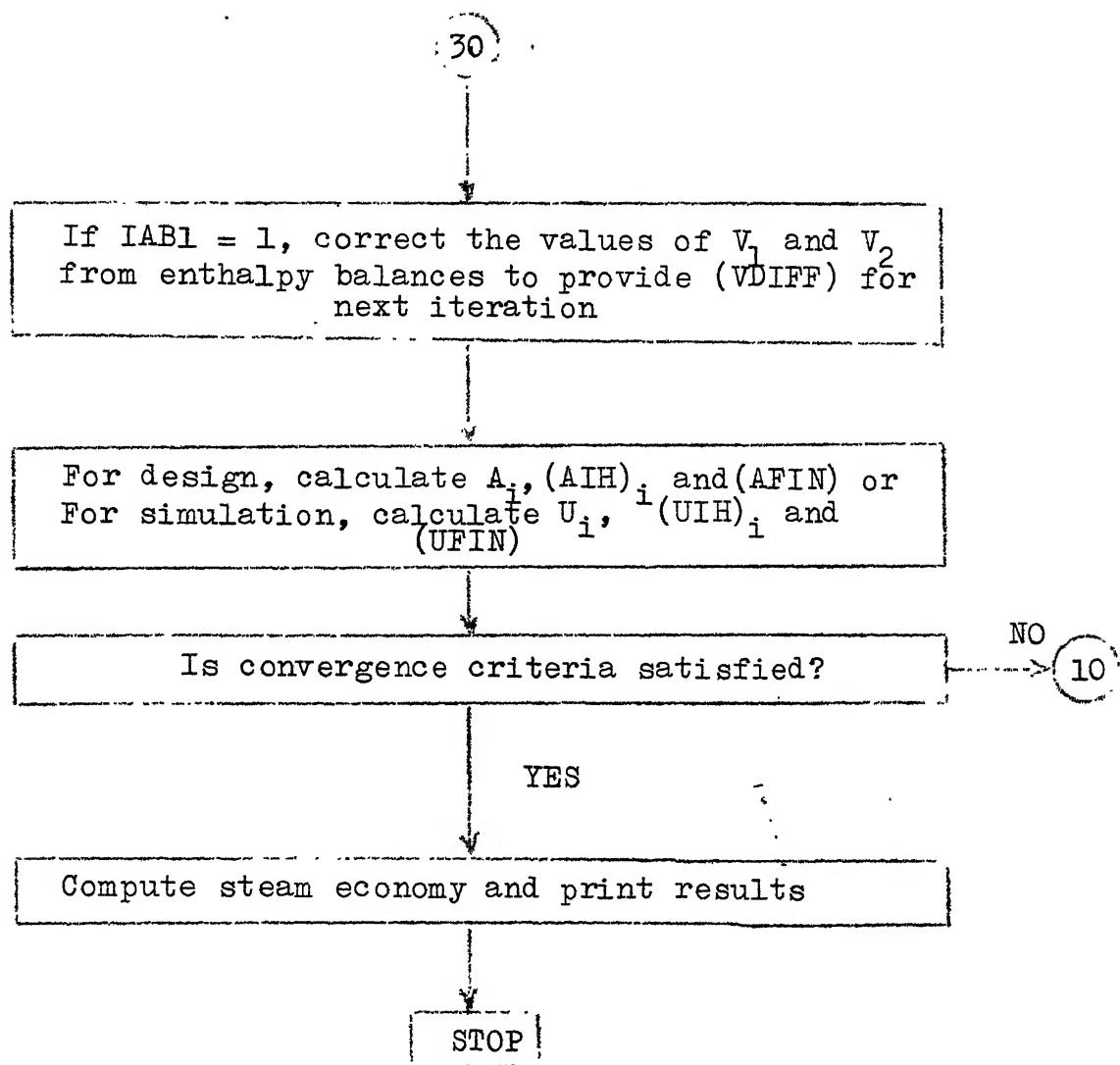
3. Arrays NORD, IFEED and IFSORD

4. Temperatures (TS), (TF), $(TC)_n$ and radiation loss fraction (RL).

5. Feed and product concentrations

6. Feed stream rates fed through IFSORD array (FF),

7. Multiple feed stream rates $(MF)_i$

8. Heat transfer coefficient U, heat transfer surface A, heat transfer rate Q, flow rates V and (LO), ●oncentrations (XLO), temperatures (TC), (TI) and (TO), temperature difference (DT), boiling point rise (BPR), enthalpies (HV), (HLI), (HLO), and (HC) for each body.

9. If IBLEED = 1, (i) ICBLED

(ii) (QB) and (VB) for each VBP

10. If IH are present, (i) IPROCH, IIH array, specified area/temperature difference ratio depending on IPROCH value.

(ii) (UIH), (AIH), (TIHI), (TIHO), (DTIH) and (QIH) for each IH.

11. If LFT are present, (i) NLORD array

(ii) (LLFTO), (VLFT), (XLLFTO) and (BPRLFT) for each LFT

12. IF CFT are present, (i) NCORD array

(ii) (CCFTO) and (VCFT) for each CFT.

13. If IFINI = 1, (i) NFOR, NVORD, RLF, number of FCFT,
    (TSFIN), (TFINO), (DTFIN),(BPRFIN),
    (HLFINO), (HVFIN), (LFINO), (VFIN),
    (XLFINO), (QFIN), (AFIN) and
    (UFIN).

    (ii) If FCFT are present, NFCORD
    array and (CFCFTO) and (VFCFT) for
    each body.

14. Product rate and total evaporation in the plant

15. Steam consumption and steam economy

16. Number of iterations required.

CHAPTER 5

PROCESS DESIGN AND SIMULATION OF EVAPORATION PLANTS BY MEEDS

Computer program 'MEEDS' developed in this work is used in solving a number of problems for design and simulation of multiple effect evaporation plants, handling diverse liquors like sugar solution, sodium aluminate liquor, kraft black liquor, sodium hydroxide, brine, gelatin and other process liquors. Several variations in evaporation plants relating to number of effects, liquor flow patterns, auxiliary features for improving steam economy and finisher evaporator are considered in these problems to demonstrate the versatility of the program.

5.1 Plant Design:

A number of evaporation plants of varying complexity are designed using the program MEEDS. A simple sextuple effect evaporation plant for concentrating alkaline spent pulping liquor (kraft black liquor) is considered at first for design purposes. Eighteen different modifications of this plant are then developed as design problems. The program is run with DESIGN = 1.0, to obtain the steam and heat transfer area requirements and steam economy. Plant configurations and

special features are summarized in Table (5.1) for the above
problems alongwith output data compiled as steam economy and
total heat transfer surface to facilitate comparison of the
many modifications included in the various cases.   The
computer print-outs giving the necessary input design data
and the output listing flow rates, mass fractions, temperatures
and enthalpies of different streams (vapor/liquor/condensate)
alongwith heat transfer rates, temperature potential, BPR
and heat transfer surface for each unit are given in Appendix D.
The design specifications for this set of eighteen problems
are based on a set of observed plant data for the concentration
of kraft black liquor in a sextuple-effect seven body evaporation
plant reported by McDonald and Franklin [19]. Some of the
necessary input data like weak liquor feed rate, terminal
concentrations, steam and feed temperatures and vacuum listed
in Table (5.2) are assumed constant for all the cases. BPR
data are calculated from subroutines BPRN and BPR1 based on
concentration. The values of overall heat transfer coefficients
for each effect are also assumed to be constant, since changes
in these would be small for the variations considered in the
set of eighteen cases. Foul condensates from the second effect
onwards are assumed to be sequentially flashed through the
succeeding effects to the last unit. The areas of all the
effects are assumed to be equal for plants 1-16. Evaporation

TABLE 5.1: COMPARISON TABLE FOR PLANTS 1-18

Plant No.	Effects N	Bodies n	LFT N_1	CFT N_2	IH N_3	VBP N_5	FIN N_6	FCFT N_7
1	6	6	0	0	0	0	0	0
2	6	6	1	2	0	0	0	0
3	6	6	1	2	0	0	0	0
4	6	6	1	2	0	0	1	2
5	6	7	1	2	0	0	0	0
6	6	7	1	2	0	0	0	0
7	6	7	1	2	0	0	0	0
8	6	7	1	2	0	0	0	0
9	6	7	1	2	0	0	0	0
10	6	7	1	2	0	0	0	0
11	6	7	1	2	0	0	0	0
12	6	7	1	2	0	2	0	0
13	6	7	1	2	0	0	0	0
14	6	7	1	2	5	0	0	0
15	6	7	1	2	5	0	0	0
16	6	7	1	2	5	0	1	2
17	6	7	1	2	5	0	1	2
18	6	7	1	2	5	2	1	2

Table 5.1 (contd)

Plant No.	IPROCH	(FPS)	IPFS	$\frac{(FF)_1}{(FPS)}$	(TMF)	Multiple feed streams	(RL)
1	-	151063	1	1.0	0	0	0.0
2	-	151063	1	1.0	0	0	0.03
3	-	151063	2	0.5	0	0	0.03
4	-	151063	2	0.5	0	0	0.03
5	-	151063	1	1.0	0	0	0.03
6	-	151063	1	1.0	0	0	0.03
7	-	151063	2	0.5	0	0	0.03
8	-	151063	2	0.5	0	0	0.03
9	-	151063	2	0.333	0	0	0.03
10	-	151063	2	0.666	0	0	0.03
11	-	151063	2	0.5	0	0	0.03
12	-	151063	2	0.5	0	0	0.03
13	-	100000	1	1.0	51063	1	0.03
14	0	151063	2	0.5	0	0	0.03
15	1	151063	2	0.5	0	0	0.03
16	1	151063	2	0.5	0	0	0.03
17	1	120000	2	0.5	31063	1	0.03
18	1	120000	2	0.5	31063	1	0.03

Table 5.1 (contd)

Plant No.	Steam Economy	Total Area	Area for IH	Remarks
1	4.154	4625	–	Fig.4.1 with no LFT and CFT
2	4.548	4561	–	Fig. 4.1
3	4.629	4631	–	Fig. 4.2
4	4.587	4392	–	Fig. 6.1
5	4.530	4502	–	Fig. 6.2
6	4.586	4508	–	Fig. 6.2 with feed to body 7
7	4.343	4511	–	Fig. 4.3 with feed to 5 and 6
8	4.611	4573	–	Fig. 4.3
9	4.654	4628	–	Fig. 4.3
10	4.566	4565	–	Fig. 4.3
11	4.662	3491	–	Fig. 4.3, $(BPR)_i=0.0$
12	4.212	4547	–	Fig. 4.3 with VBP from 2 and 3
13	4.613	4483	–	Fig. 4.6
14	4.825	4931	364	Fig. 4.4
15	4.851	4939	361	Fig. 4.4
16	4.826	4720	357	Fig. 4.5
17	4.858	4664	301	Fig. 4.7
18	4.351	4619	311	Fig. 4.8

TABLE 5.2: <u>COMMON DATA FOR PLANTS 1-18 FOR DESIGN CALCULATIONS</u>

1. LF = 151063.0 kg/h
2. XLF = 0.1393
3. XLP= 0.520
4. TF = 71.11 $^{\circ}$C
5. TS = 135.56 $^{\circ}$C
6. TC_{n+1} = 51.67 $^{\circ}$C
7. FCHEAT = 1.0
8. KALBPR = 1

9. U-values (kW/m^2K)

When IAB1=0, U_1=1.18050

U_2= 2.22533

U_3= 2.19186

U_4= 1.79437

U_5= 1.36282

U_6= 1.07890

When IAB1 = 1, U_1= 0.98804

U_2= 1.37417

U_3=2.22593

U_4= 2.19186

U_5= 1.79437

U_6= 1.36282

U_7= 1.07890

10. Area ratios among different bodies as given in individual outputs

11. When IBLEED=1 and IAB1=1

(a) ICBLED = 0   (b) $(QB)_2$=10000 kW (c) $(QB)_3$=10000 kW

12. When IH are present and IAB1 = 1

       (a) IIH array = 0 0 1 1 1 1 1

       (b) U-value for each IH equal to corresponding body U-value

       (c) When IPROCH = 0 , (RIH) = 0.08 and when IPROCH = 1 , (RIH1)= 0.80

13. When IFIN1 = 1,

       (a) TSFIN = 176.67 $^{\circ}$C

       (b) UFIN = 0.85176 kW/m^{2}K

       (c) RLF = 0.015

—x—

plants with two-tube passes in first effect are assumed to
have equal area for each pass and in turn representing one
half the corresponding value for the other effects. Plants 17
and 18 have a specified area ratio among the heat transfer
surface of the various effects.

The addition of one LFT and two CFT to the simple
sextuple-effect evaporation plant-1 improves the steam economy
to 4.548 from 4.154 and also a small decrease (1.5 per cent)
in total area is observed from 4625 to 4561 m^2 as illustrated
by output for plant-2 in Appendix D. The program for this
plant also accounts for radiation heat losses assumed to be
3 per cent of heat input through steam. Split flow of equal
amounts of feed liquor in parallel to fifth and sixth effects
in Plant-3 improves steam economy to 4.629. The change in area
requirement is rather small (4631 m^2). The effect of a finisher
evaporator in Plant-4, shown in Fig. (5.1) gives a steam
economy 4.587 and with a decrease of 5 per cent in total area
compared to Plant-1.

Provision for two-tube passes in first effect of
Plant-5, depicted in Fig. (5.2) with feed liquor introduced
in sixth body has steam economy 4.53 and total area 4502 m^2.
Feeding weak liquor to seventh body (instead of sixth) in
Plant-6 improves steam economy to 4.586 with essentially same
total area as in Plant-5. Parallel feed of weak liquor in

6 To vac.

Comb.
cond.

FF₁

LF(feed)

FF₂

S

To 4

To 3

SFIN

To 3

To 2

To 3

To 2

LP(product)

To boiler

To 2

To 3

CFT₁   CFT₂   FCFT₂   FCFT₁   FIN   LFT₁
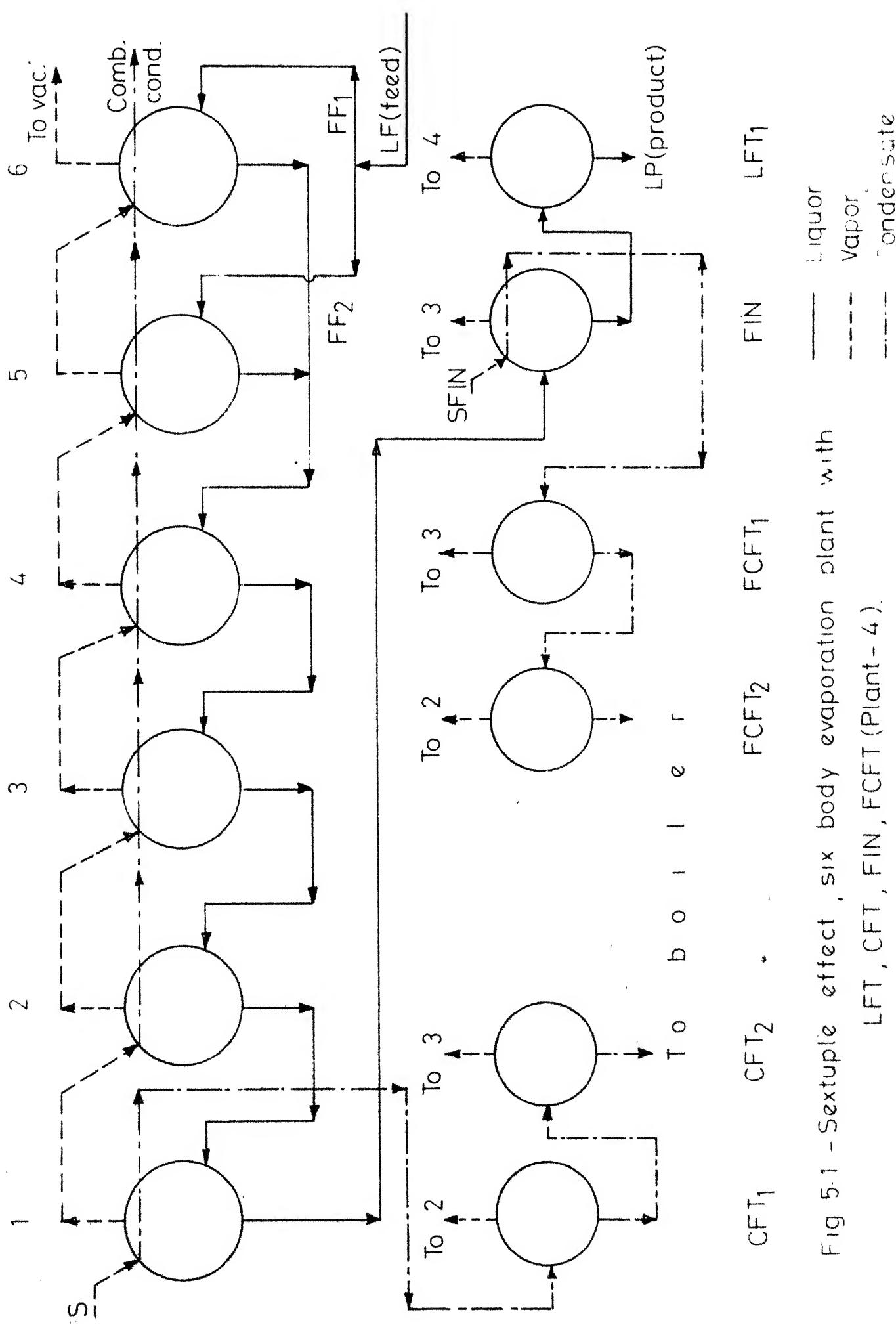
Fig 5·1 – Sextuple effect, six body evaporation plant with
LFT, CFT, FIN, FCFT (Plant - 4).

Liquor
Vapor
Condensate
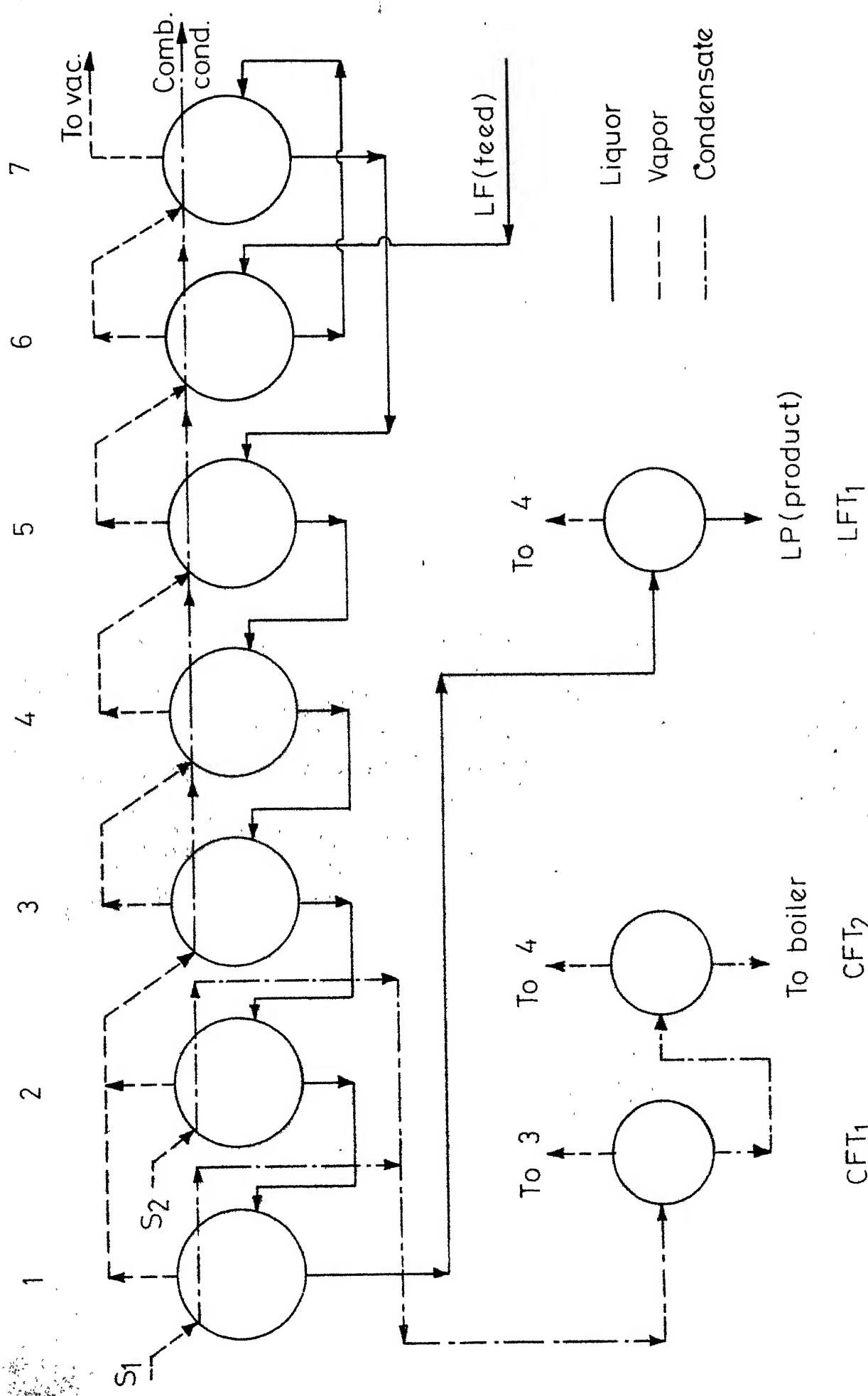
Fig. 5.2 – Sextuple effect seven body evaporation plant with LFT, CFT (Plant–5).

equal proportions to bodies 5 and 6 in Plant-7 and to bodies 6 and 7 in Plant-8 give steam economy of 4.343 and 4.611 with total area of 4511 and 4573 m² respectively. Split feed arrangement introducing two-third (Plant-9) or one-third (Plant-10) of total weak liquor to sixth body (and balance to seventh body) gives steam economy of 4.654 and 4.566 with area of 4628 and 4565 m² respectively. These comparisons are based on the assumption that effect of 15-20 per cent change in liquor rate on U-values are small.

The effect of BPR is assumed to be negligible in Plant-11 and compared with the results for Plant-8. This assumption gives a slightly higher value of steam economy (4.622 vs 4.611) and shows a 23 per cent decrease in total area requirement (3491 vs 4511 m²). These results show the important role of BPR in evaporation process engineering calculations which when neglected gives an underdesigned plant.

Plant-12 illustrates the principle of vapor bleeding. The vapors are withdrawn from first and second effect of the evaporation plant and steam economy of this plant comes down to 4.212 from 4.611 with a minor decrease in area requirement (4547 vs 4573 m²) compared to that of Plant-8.

The seventh body in Plant-13 receives weak liquor in addition to overflow liquor stream from sixth body, constituting a multiple feed stream concept as shown in Fig. (4.6). On

comparing the results of this plant with Plant-5 in which all the weak liquor was fed to sixth body only, it is found that steam economy improves to 4.613 from 4.530 with a negligible change in area requirement.

Plant-14 is a modification of Plant-8 and has integral heaters in bodies 3 to 7. In the design calculations of this plant, the area of each integral heater is assumed to be 8 per cent of the area of the respective body. Preheating of liquor through the integral heaters improves steam economy (4.825 vs 4.611) with total area 4931 m^2 (including area 364 m^2 required for IH). The same observation concerning steam economy (4.851 vs 4.611) is also evident in the case of Plant-15, which assumes a fixed temperature differential approach (80 per cent) in the integral heater for the process calculations.

A modification to Plant-15, with the addition of one finisher and two FCFT gives scheme for Plant-16 in Fig. (4.5). Plant-16 gives steam economy of 4.826 and area 4720 m^2 (357 m^2 for IH) compared to the corresponding values of 4.851 and 4938 m^2 for Plant-15.

Plant-17 represented by Fig. (4.7) has one multiple feed stream to body 5 and two other parallel feed streams to bodies 6 and 7, and has a specified area ratio (A_1 = 0.8 A_2=0.64 A_3=0.64 A_4=0.64 A_5=0.512 A_6=0.512 A_7). For this plant steam economy is 4.858 and total area is 4664 m^2 (301 m^2 for IH).

Plant-18 represents the above scheme of Plant-17 with vapor bleeding from first and second effects, as depicted in Fig. (4.8), with steam economy of 4.351 and total area 4619 m^2 (311 m^2 for IH).

Thus the above problems illustrate the quantitative effect of the several auxiliary features and liquor feed arrangements on the values of steam economy and heat transfer surface requirement of the sextuple-effect evaporation plant handling kraft black liquor.

The computer program MEEDS developed in this study can thus handle all the cases included in Table (6.1). In addition to these problems several other examples are considered next; some of these include design of triple-effect evaporation plant for handling diverse process liquor, sextuple-effect six-body plants, sextuple-effect seven body plants and quintuple-effect six-body plants for processing kraft black liquor, quintuple effect six-body plant for sugar solution and quadruple-effect four-body plant for concentrating sodium aluminate and other solutions.

A simple triple-effect evaporation plant design problem is solved by MEEDS with both forward (Plant-19) [Kern (20a)] and backward feed flow (Plant 20) [Kern (20b)] arrangements. BPR is assumed to be negligible and specific heat of solution assumed as 4.1868 kJ/kg ^{o}C and radiation

losses are neglected. Steam economy of Plant-19 is 2.112 with total area of 428 m^2 and is within 4 per cent of Kern's results (2.209 and 446 m^2). Plant-20 with steam economy 2.408 and total area 409 m^2 compares within 1.5 per cent of Kern's values (2.375 and 415 m^2).

The design problem for the concentration of kraft black liquor in sextuple-effect six-body evaporation plant (Plant-21) [Kern (20c)] also was solved by MEEDS. The total area of plant 1816 m^2 and steam economy of 4.29 agree within 5 per cent of Kern's results [1810 m^2 and 4.50]. This plant is essentially the same as Plant-3 included in Table (5.1) and CFT are absent.

Another example of sextuple-effect six-body evaporation plant (Plant-22) with one LFT and two CFT processing kraft black liquor with liquor flow pattern similar to Plant-3 is considered. The design constraint on area specifies that $A_1=A_2=A_3=0.8A_4=0.8$ $A_5 = 0.8$ A_6. This plant requires 3577 m^2 area and gives steam economy 4.766.

Plant-23 is a modification of Plant-22 with the difference that the first effect has two-tube passes similar to Plant-8. The computed values of total area and steam economy of this plant are 3530 m^2 and 4.75 respectively.

Evaporation plant data for concentration of kraft black liquor in sextuple-effect seven-body evaporation plant

discussed in Libby [21] is solved as a design problem by MEEDS and the values of total area and steam economy are 4571 m^2 and 4.33 and agree within 8.0 per cent of original results. [4660 m^2 and 4.66].

Sextuple-effect seven-body evaporation plant (Plant-25) processing kraft black liquor is shown in Fig. (5.3) and has two LFT, two CFT and five IH. Design calculations with area constraint $A_1=A_2=0.5$ $A_3=0.5$ $A_4=0.5$ $A_5 = 0.5$ $A_6 = 0.$ A_7 and specified area approach [(RIH) = 0.08] for IH requires total area 8168 m^2 (510 m^2 for IH) and gives steam, economy of 5.25. Similar results are obtained when MEEDS is run with specified temperature differential approach [(RIH1) = 0.8] for IH in Plant-26 with steam economy of 5.28 and total area 8273 m^2[616 m^2 for IH). A variation of this scheme is considered in Plant-27 with a different set of area constraints $A_1=A_2=0.5$ $A_3=0.45$ $A_4=0.45$ $A_5=0.45$ $A_6=0.45$ A_7 and gives steam economy of 5.305 and area 8277 m^2 (613 m^2 for IH).

A quintuple-effect six-body evaporation plant (Plant-28) handling the black liquor is shown in Fig. (5.4) and includes one LFT, two CFT and three IH. The design constraint requires $A_1=A_2=0.5$ $A_3= 0.5$ $A_4 = 0.5$ $A_5=0.5$ A_6 and a specified temperature differential approach [(RIH1) = 0.8] is to be used for IH. In this scheme vapor line from LFT is shown connected to steam chest of body 4; since the liquor from third body is
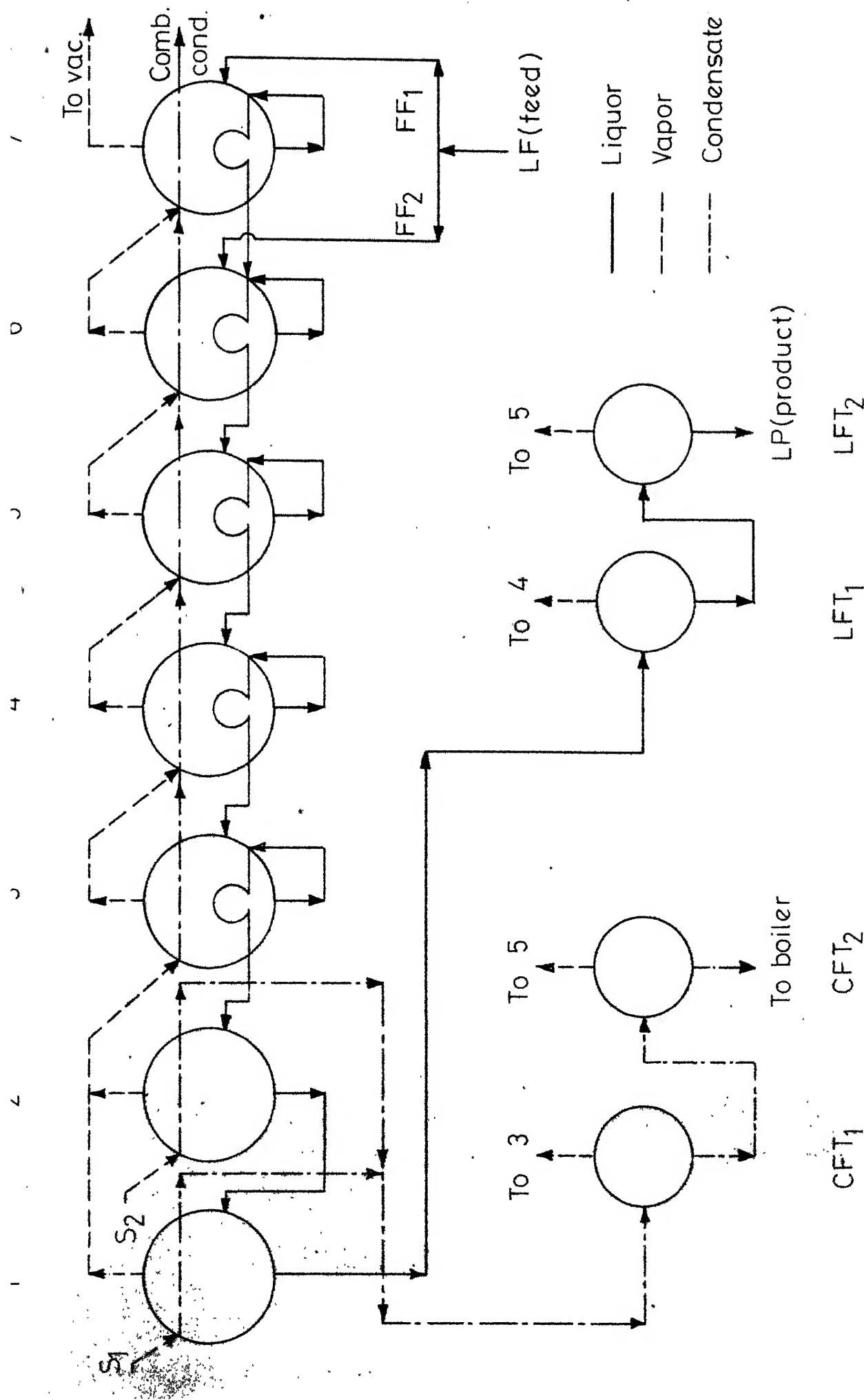
Fig. 5.3 – Sextuple effect seven body evaporation plant with LFT, CFT, IH (Plant-25).

99
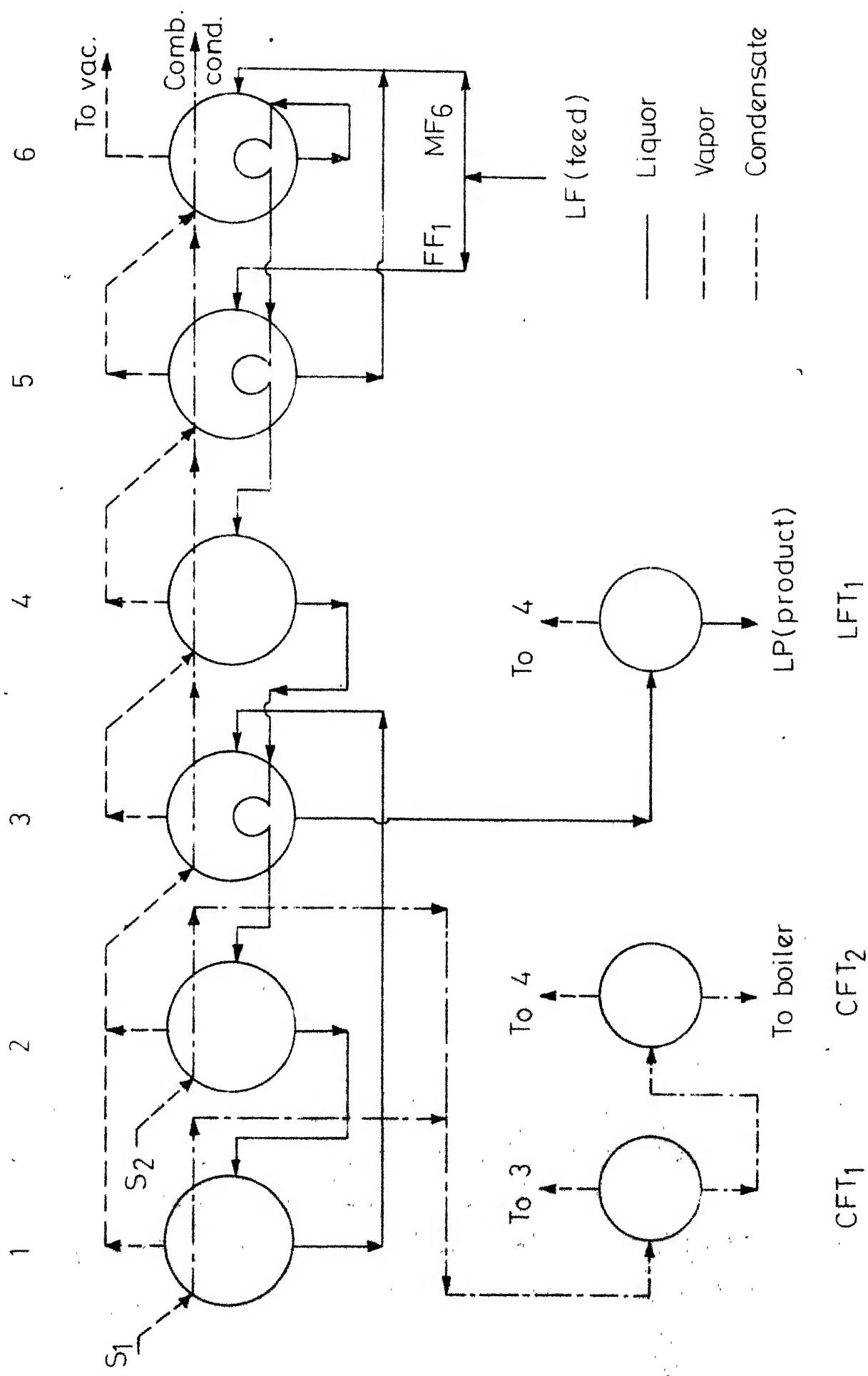
Fig. 5.4 – Quintuple effect six body evaporation plant with LFT, CFT, IH (Plant-28)

Liquor

Vapor

Condensate

LF (feed)

MF$_6$

FF$_1$

LP (product)

To vac.

Comb. cond.

To boiler

To 4

To 3

S$_1$

S$_2$

CFT$_1$

CFT$_2$

LFT$_1$

fed to LFT and vapors from third body goes to the steam chest of fourth body, the desired flashing is not obtained. Instead some vapors from steam chest will flow to the LFT as shown by the negative value for the vapor flow from LFT in the output of Plant-28 in the Appendix -D. With the vapor line from LFT connected to steam chest of fifth body in Plant-29, steam economy is 4.27 and requires total area of 1814 m^2 (110 m^2 for IH).

The sextuple-effect seven-body plant (Plant-30) represented by Fig. (5.5) has one finisher effect, one LFT, one CFT and five IH and evaporates the black liquor from 13 to 52 per cent concentration. For the area constraint $A_1=A_2=0.5$ $A_3 = 0.5$ $A_4 = 0.35$ $A_5 = 0.35$ $A_6 = 0.35$ A_7 and specified area approach [(RIH) = 0.1], MEEDS gives steam economy 4.88 and total area 12075 m^2 [959 m^2 for IH].

Figure (5.6) shows one more sextuple-effect seven-body evaporation plant (Plant-31) for evaporating black liquor from 15 to 67 per cent and has one finisher effect, one LFT and five IH. Weak black liquor is fed in parallel in the proportion of 1/3 and 2/3 to bodies 5 and 6; liquor overflow from sixth body goes to body 7 and overflow of body 7 after preheating in IH_7 and IH_6 is combined with the weak liquor to fifth body. This is another example of multiple feed concept-discussed earlier in case of Plant-13. The finisher receives the feed liquor from second body. With area constraint
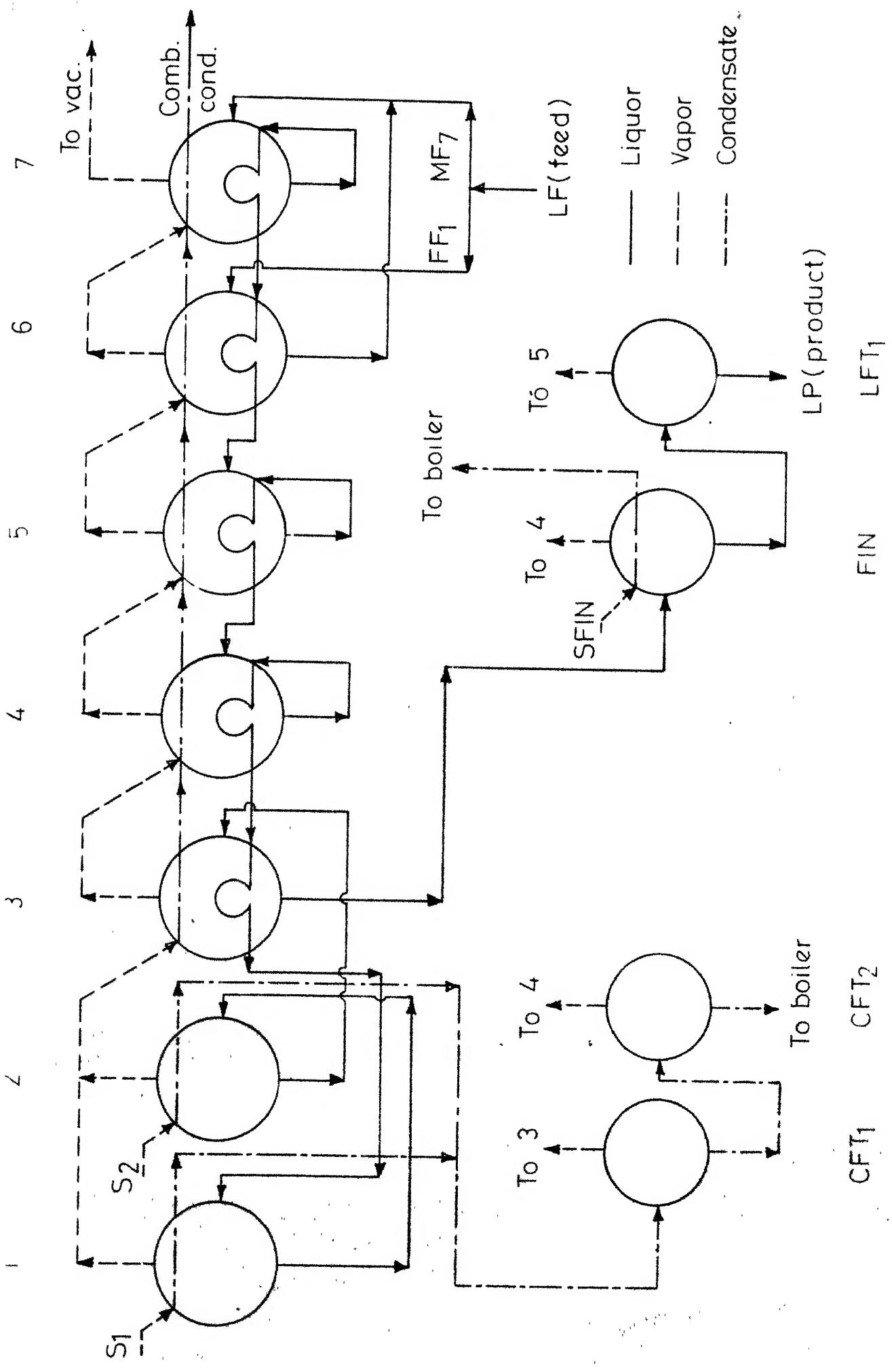
Fig. 5.5 - Sextuple effect seven body evaporation plant with LFT, CFT, IH, FIN (Plant-30). 102
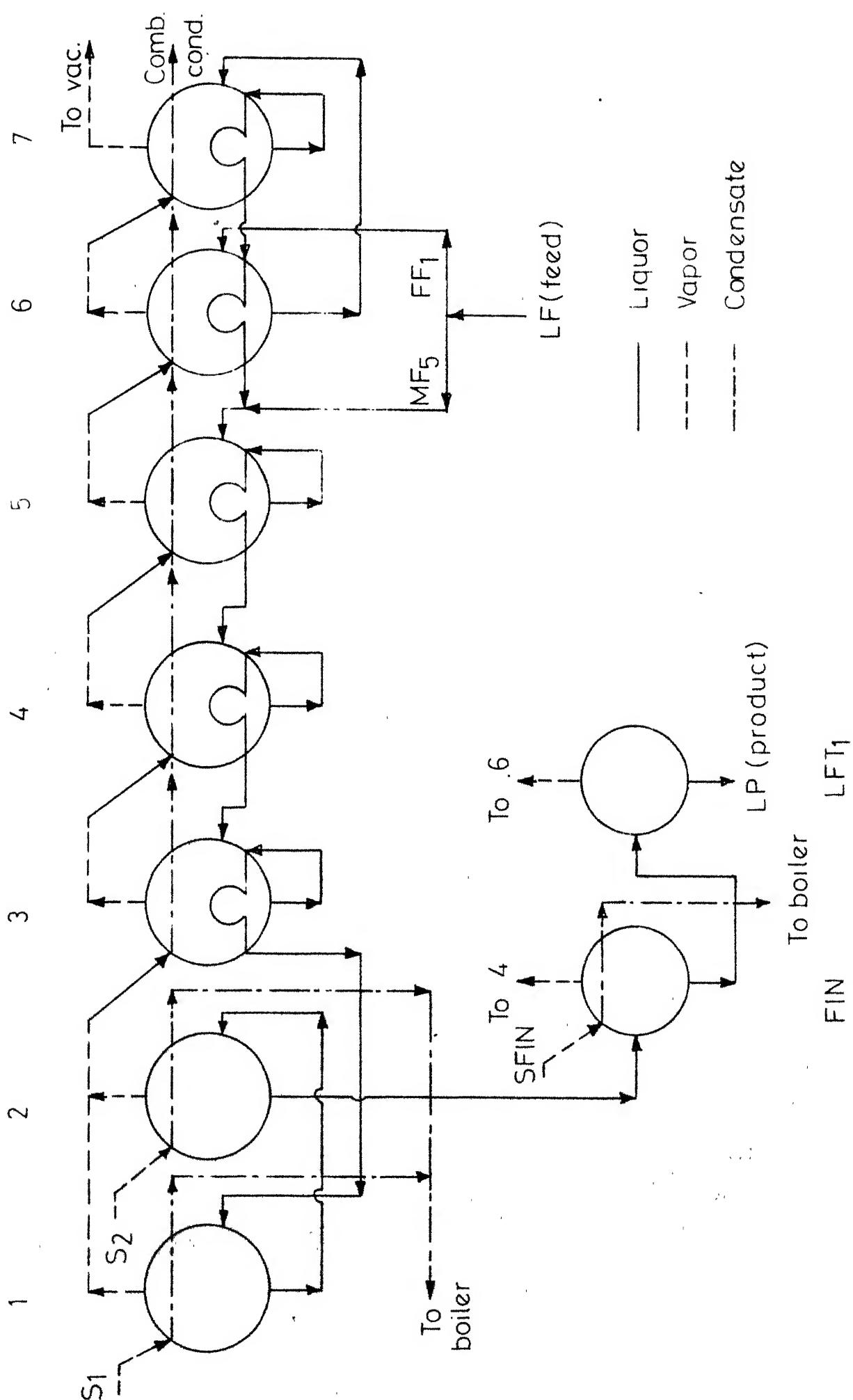
Fig 5.6 - Sextuple effect seven body evaporation plant with LFT_1, JH, FIN (Plant-31)

Legend:
——— Liquor
———·— Vapor
——··—— Condensate

Labels on diagram: To vac., Comb. cond., S_1, S_2, To boiler, LF (feed), FF_1, MF_5, SFIN, To 4, To boiler, To 6, LP (product), FIN, LFT_1, LP (product)

163

$A_1 = A_2 = 0.464$ $A_3 = 0.276$ $A_4 = 0.276$ $A_5 = 0.246$ $A_6 = 0.246$ A_7

and specified temperature differential approach [(RIH1) = 0.8]

for IH, the program gives the steam economy of 4.89 and total

area 17703 m^2 (1150 m^2 for IH).

A quintuple-effect six-body evaporation system (Plant-

32) is shown in Fig. (5.7) for concentrating sugar solution.

This example is taken from Kern [20d]. Liquor flows in the

normal forward flow manner. Some of the vapors from first four

effects are withdrawn as bleed streams for heating raw juices

and for the vacuum pans in crystallizing sections. Since the

heat duty required from vapor bleed stream withdrawn from

first effect is very high, vapor flows are initialized as

$[V_1=V_2=V_2=V_4=V_5=V_6]$ in stead of $[V_1=V_2=0.5$ $V_3=0.5$ $V_4= 0.5$ $A_5 =$

0.5 $A_6]$. MEEDS gives total area and steam economy 2370 m^2

and 2.224 respectively and is in very good agreement with

Kern's results 2370 m^2 and steam economy 2.215.

A typical quadruple-effect four-body evaporation plant

(Plant-33) for concentrating aluminate liquor is shown in

Fig. (5.8). The feed is preheated in the four integral

heaters and then feed to first effect from where it follows

forward feed flow pattern. Plant-33 has three CFT as auxiliary

heat recovery units. With minor modifications for preheating

of the feed solution MEEDS gave area of 1141 m^2 (104 m^2 for IH)

and steam economy of 3.57.
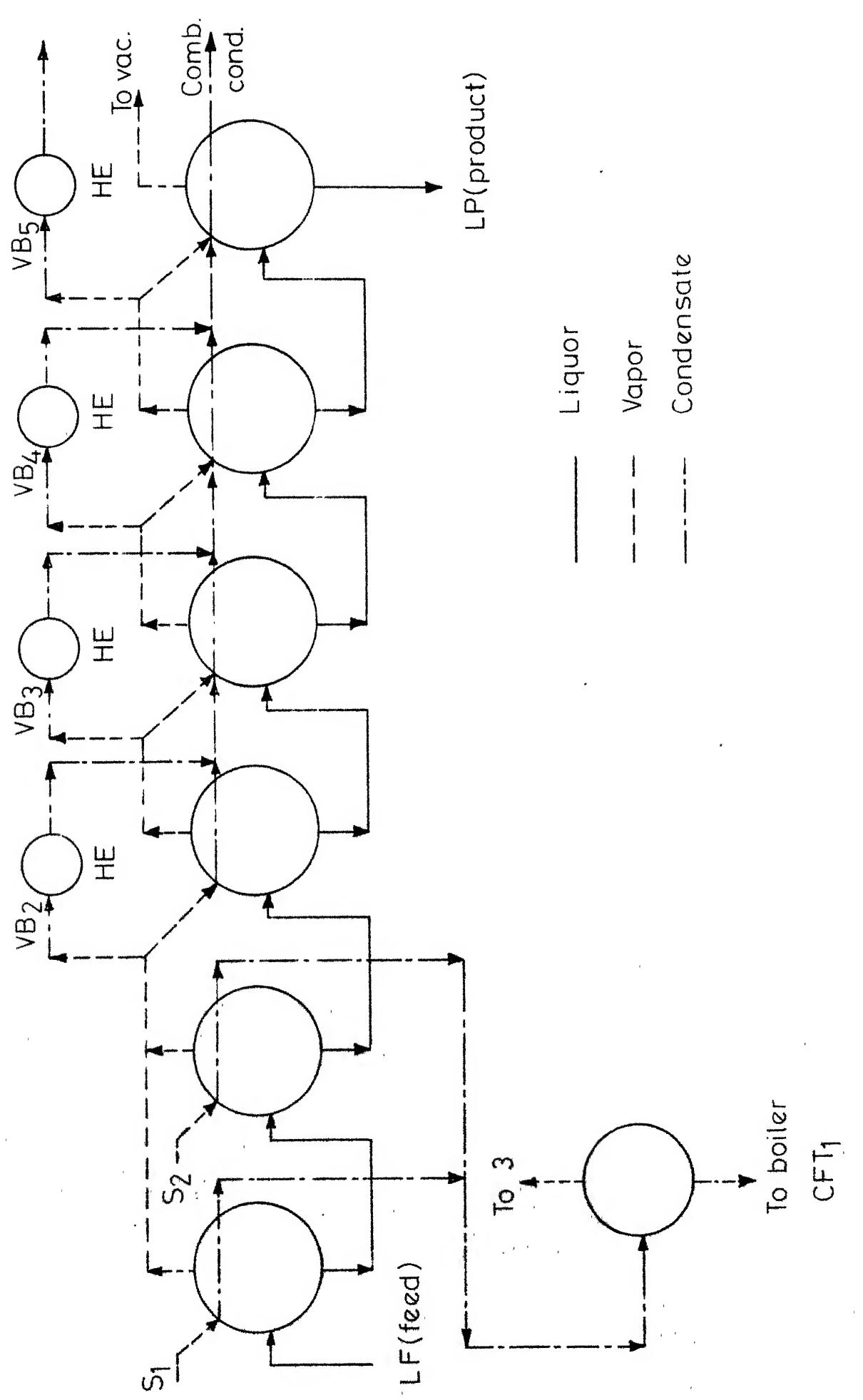
Fig. 5·7 — Quintuple effect six body evaporation plant with CFT, VBP [Plant-32]

Liquor ——————
Vapor — — — —
Condensate —·—·—·

Fig. 5 8 - Quadruple effect four body evaporation plant with CFT, IH (Plant - 33)

Legend:
- Liquor
- Vapor
- Condensate

To vac.

Comb. cond.

LF (feed)

LP (product)

S

To 2   To 3   To 4   To boiler
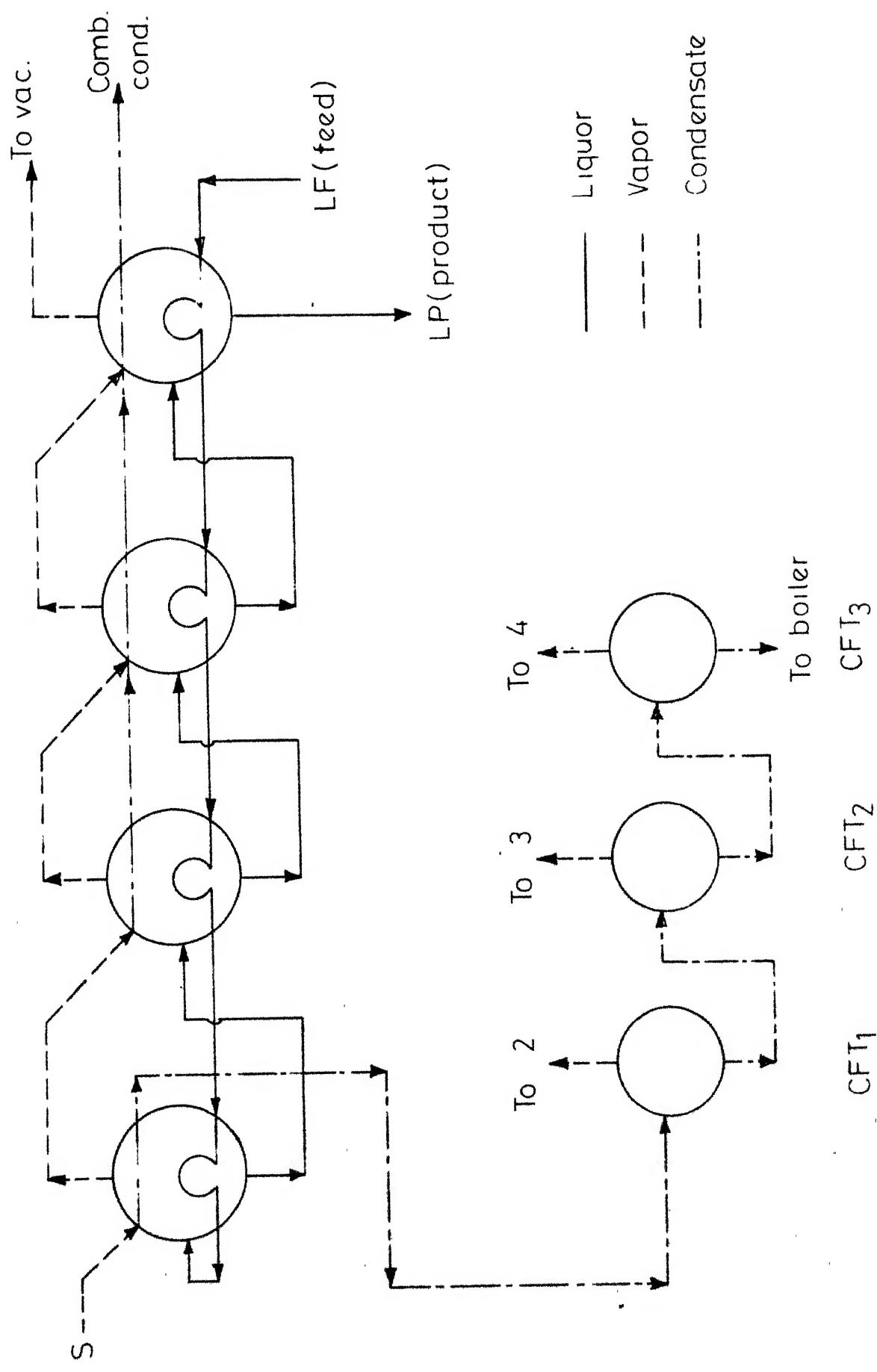
CFT₁   CFT₂   CFT₃

Several other design problems of evaporation plants processing different liquor also have been solved by MEEDS. A triple-effect forced circulation plant for concentrating sodium hydroxide solution is considered as Plant-34 with forward feed arrangement [22a]; steam economy is 2.083 and total area requirement is 966 m^2 and are in very good agreement with reported results [2.06 and 975 m^2][22a]. A change in one of the input parameter of Plant-34, for example, steam temperature of 131°C instead of 113.2°C and assuming that all others conditions remain same, Plant-35 gives steam economy of 1.957 and requires heat transfer surface 535 m^2; this agrees very well with reported results (1.95 and 544 m^2)[22b]. Modifying Plant-34 for backward feed arrangement gives the steam economy and heat requirement of Plant-36 as 2.0519 and 888 m^2 [22c].

Plant-37 is a triple-effect forward feed evaporation plant considered by McCabe and Smith [23a]. MEEDS gave excellent agreement in the steam economy and area requirements as (1.96 and 327 m^2 versus 1.96 and 334 m^2) [23a].

A quadruple-effect evaporation plant considered by Coates [8] was designed next as Plant-38. The steam economy and surface requirements of Plant-38 as computed by MEEDS are 3.508 and 321 m^2 whereas the accurate method of Coates estimates them as 3.17 and 351 m^2 and Coates approximate calculation procedure gave 3.13 and 359 m^2.

Plant-39 represents another quadruple-effect evaporation plant processing a chemical solution considered by Ray and Carnahan [3]. This plant has steam economy of 2.491 and requires 105 m^2 area.

Another triple-effect forced circulation evaporation plant with mixed feed arrangement for concentrating caustic soda solution [23b] is designed by MEEDS to give steam economy of Plant-40 as 2.579 and requiring 89 m^2 area.

The execution time for the program for the design calculations of all multiple effect evaporation plants considered so far is 1-15 s. For many of the plant considered the desired convergence is obtained in 3-7 iterations except in cases like Plant 24, 30, 31, 32 and 33 which required up to 14 iterations.

5.2 Simulation:

The program MEEDS has also been used for simulation studies of several evaporation plants. The computer outputs are given in Appendix E. The effect on plant performance and steam economy is predicted following a change in some of the input parameters like steam pressure, feed temperature, concentration and flow rate, desired product concentration and vacuum. A sextuple-effect seven-body evaporator plant (Plant-8) processing kraft black liquor is used as the basis to evaluate the influence of the above fluctuations on plant operation and

performance. The results obtained from the program MEEDS for the various cases included in this analysis are summarised in Table (5.3) which gives steam consumption and economy of the plant and U-values of different effects. It is assumed that all variables, except the one under study, have the same values as given in the design specification for Plant-8. In these particular problems it is assumed that the values of overall heat transfer coefficient depend only on heat flux, liquor rate and temperature levels for the minor change in performance. The design U-values and steam consumption and economy for Plant-8 are given in top row of Table (5.3).

An increase in steam temperature to 150°C from 135.56°C (Plant - 101) decreases the steam economy to 4.371 from 4.611 due to lower (2.2 per cent) lower heat of vaporization at 150°C. Another effect of this change is an increase in overall temperature difference [98.33°C vs 83.89°C], tending to give lower U-values for the same total evaporation duty.

The steam economy increases to 5.095, when feed temperature is raised from 71.1 to 100°C (Plant-102). This is mainly attributed to a decrease in heat transfer in different effects because of flashing of feed liquor. The values of overall heat transfer coefficient also decreases to some extent.

A fall in vacuum on last effect also decreases steam economy. In Plant - 103 saturation temperature of vapors from

TABLE 5.3: <u>EFFECT OF CHANGES IN INPUT PARAMETERS ON THE PERFORMANCE</u>
<u>OF A SEXTUPLE EFFECT SEVEN BODY EVAPORATION PLANT PREDICTED</u>
<u>BY MEEDS</u>

Plant No.	Parameter fluctuating	Original Value	New Value	S	SE	U_1	U_2	U_3	U_4	U_5	U_6	U_7
8	-	-	-	23983	4.611	0.988	1.375	2.226	2.192	1.794	1.363	1.079
101	(TS)	135.56	150.0	25300	4.371	0.811	1.129	1.828	1.800	1.474	1.119	0.886
102	(TF)	71.11	100.0	21706	5.095	0.946	1.316	2.132	2.100	1.718	1.305	1.033
103	$(TC)_{n+1}$	51.67	57.0	24094	4.590	1.078	1.499	2.428	2.391	1.957	1.486	1.177
104	(XLF)	0.139	0.17	22978	4.425	0.960	1.336	2.165	2.132	1.745	1.325	1.049
105	(XLP)	0.52	0.56	24292	4.644	1.019	1.417	2.296	2.261	1.851	1.406	1.113
106	(LF)	151063	140000	22227	4.611	0.916	1.273	2.063	2.031	1.663	1.263	1.000
107	$(FF)_1$	75531.5	67978.4	23915	4.625	0.990	1.377	2.231	2.197	1.798	1.366	1.081
108	$(FF)_1$	75531.5	83084.6	24053	4.598	0.986	1.372	2.224	2.189	1.792	1.361	1.077

<u>Input Parameters for Plant-8:</u> (TS) = 135.56, (TF) = 71.11, $(TC)_{n+1}$ = 51.67, (XLF) = 0.139

(XLP) = 0.52, (LF) = 151063, $(FF)_1$ = 75531.5, $(FF)_2$ = 75531.5

TF, TC, TS - °C
LF, FF, S - kg/h
U - kW/m^2K

last effect is increased from 51.67°C to 57.0°C (710 mm Hg, 690 mm Hg vac.) [1 mm Hg = 133.32 N/m²] and steam economy reduces to 4.59. This decreases the overall temperature difference driving potential available and for same evaporation duty U values will be somewhat higher.

When feed concentration is increased to 0.17 from 0.139, the steam economy of Plant-104 decreases to 4.425. This is caused by a decrease in evaporation duty which also results in a minor decrease in U-values.

An increase in product concentration to 0.56 instead of 0.52 gives steam economy of 4.644 and a small increase in overall heat transfer coefficient because of higher evaporation duty (Plant-105).

Decreasing feed rate by 7 per cent [15106.3 vs 140000 kg] (Plant-106) gives same steam economy as Plant-8. However, U-values also decrease somewhat due to decreased liquor through-put and hence a reduction in evaporation load.

The cases considered so far (Plant 101 to 106) assumed that feed liquor was admitted in equal proportions to bodies 7 and 6; with a feed proportion of 0.45 and 0.55 (Plant-107), steam economy increases slightly to 4.625 while a small decrease (4.598 vs 4.611) is observed when feed is introduced in the ratio of 55 and 45 per cent to bodies 7 and 6 respectively (Plant-108). There is no significant change in U-values in these cases.

In the next illustration on simulation of evaporation plant it is assumed that the second effect of a sextuple-effect seven-body evaporator system is bypassed for maintenance purposes and that the plant operates with terminal conditions similar to Plant-8. For this case (Plant - 109) vapor lines from CFT are connected to third and fourth effect and that from LFT to fourth effect. This plant with second effect cut off has a steam economy of 3.954 only and the average U-value for the plant increases.

An example of plant expansion is given as Plant-110, which is obtained from Plant-29 with the addition of one more effect placed in between the second and third effects of the latter system. With this arrangement steam economy improves to 5.025 from 4.275.

It is often necessary to estimate the rate of scale deposits and their effect on plant operation. The influence of such deposits on the U-values of the different effects•an also be obtained from the program MEEDS using observed operating data from the plant. Overall heat transfer coefficients can be determined from a knowledge of temperature distribution or intermediate liquor concentrations and area of the effects.

The values of (DT) from Plant-3 and design values of area are used to evaluate U-values in Plant-201 treated as a simulation problem. Exactly matching values of steam

and heat transfer coefficient are obtained in both the cases.

Next, simulation of a sextuple-effect seven-body evaporation system (Plant-202) is considered, Fig. (4.3) [Plant-8 as a design problem]. In this case in addition to (DT) and A, S_1 and S_2 will be necessary as part of the input data to determine U-values. These input parameters are again taken from Plant-8 and and U-values are determined for Plant-202 as a simulation problem and the results match precisely with the design U-values. It may be pointed out that the separate values of S_1 and S_2 are not easily obtained from an operating evaporation plant and hence it will be necessary to have the concentration of liquor passing from the first to the second pass of the first effect as one of the input values. For simulation of sextuple-effect seven-body evaporation plant (Plant-203) using the basic data of Plant-8 with an intermediate liquor concentration of 41.6 per cent for the two-pass first effect, the U-values obtained from MEEDS are in perfect agreement with the design values. Similar agreement is also obtained for Plant-204, based on data of Plant-24 for a sextuple-effect seven-body evaporator system with intermediate liquor concentration of the two bodies of first effect as part of the input data.

Several additional plants were also solved as simulation problems using the results obtained earlier as

design case studies and the agreement was exact in all the
cases.

Coats [24] has considered performance evaluation
of a sextuple-effect seven-body evaporation plant, depicted
in Fig. (5.9), processing kraft black liquor. A computer
program was developed by Coats requiring the following
input data: gage reading from each dome and chest, feed
liquor rates to the respective bodies, feed temperature,
steam consumption, barometric pressure, concentration of feed
and product liquors, inlet and outlet temperatures of water
to the surface condenser and condensate outlet temperature.
The computer outputs for three sets of plant observations
presented give the details for the different process variables.
A summary of these results is given in Table (5.4). The
results obtained using the program MEEDS are also given in
Table (5.4) and can be compared with the values of Coats.
Input data used with MEEDS include temperatures of liquor,
condensate and vapor streams, feed temperature, feed concen-
tration and flow rates, product concentration, steam tempera-
ture, and intermediate liquor concentration of the two-pass
first effect.   The differences in the two set of results in
Table (5.4) are small and may be attributed to possible
differences in the different empirical relations used for the
properties of black liquor.
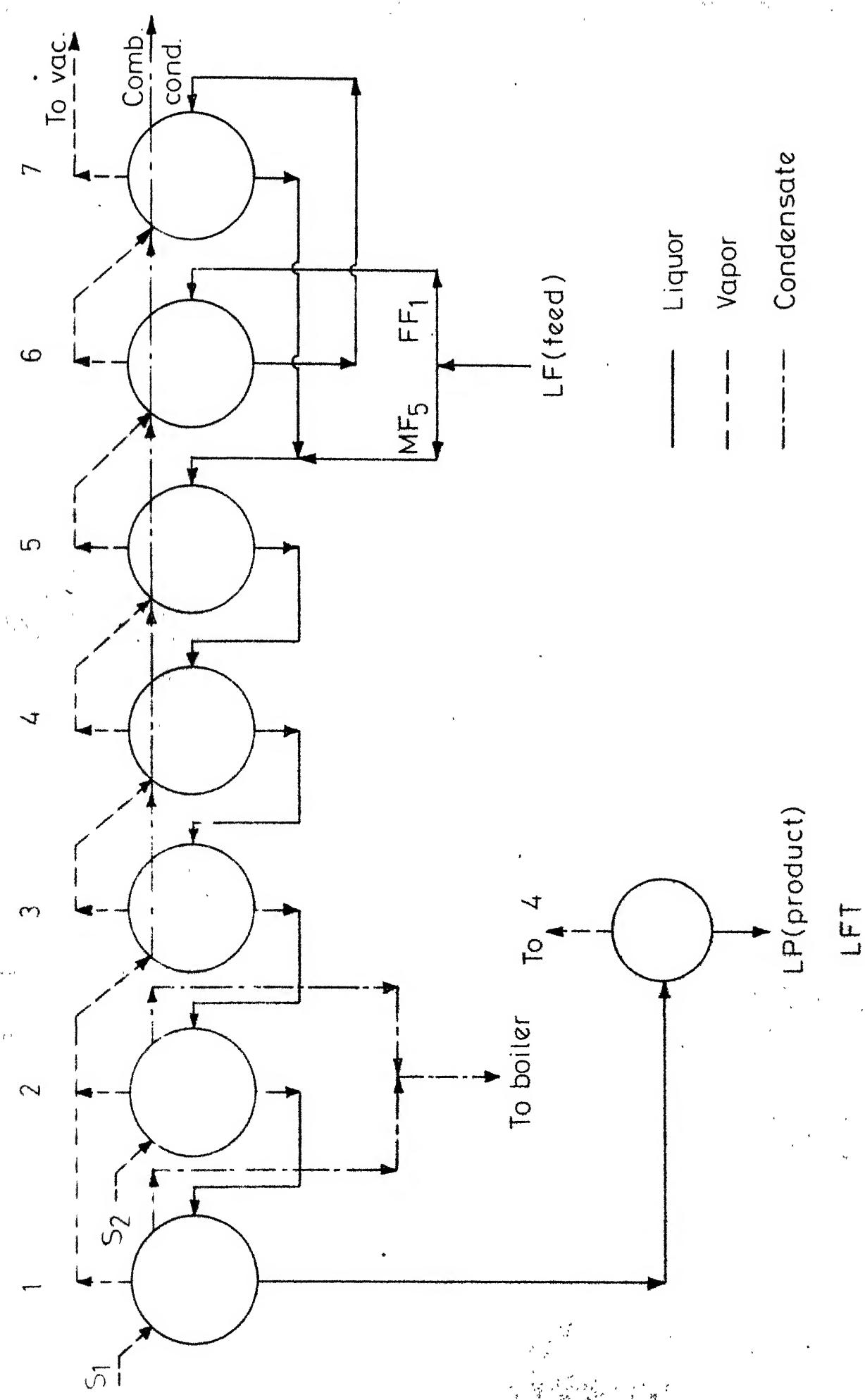
Fig 5 9 – Sextuple effect seven body evaporation plant with LFT (Plant-205).

Liquor — — — — — Vapor — · — · — Condensate

TABLE 5.4: SIMULATION OF SEXTUPLE EFFECT SEVEN BODY
EVAPORATION PLANT FOR KRAFT BLACK LIQUOR
[COATS, (24)]

S.No.	Parameter	Program Output [24]			MEEDS Output		
		1	2	3	1	2	3
1	(LF)	150000	138900	110300	150000	138900	110300
2	(XLF)	0.147	0.143	0.149	0.147	0.143	0.149
3	(XLP)	0.531	0.506	0.480	0.531	0.506	0.480
4	$(FF)_1$	85700	81900	64800	85700	81900	64800
5	$(MF)_5$	64300	57000	45500	64300	57000	45500
6	(TS)	136.6	143.2	140.9	136.6	143.2	140.9
7	(TF)	81.1	81.1	78.33	81.1	81.1	78.33
8	$(TC)_{n+1}$	51.2	60.8	68.12	51.2	60.8	68.12
9	$(XLO)_1$	0.514	0.488	0.460	0.517	0.483	0.462
10	$(XLO)_2$	0.450	0.427	0.408	0.449	0.427	0.408
11	$(XLO)_3$	0.354	0.340	0.331	0.356	0.340	0.329
12	$(XLO)_4$	0.277	0.268	0.266	0.275	0.263	0.259
13	$(XLO)_5$	0.232	0.223	0.224	0.229	0.218	0.217
14	$(XLO)_6$	0.187	0.179	0.183	0.184	0.177	0.181
15	$(XLO)_7$	0.270	0.251	0.246	0.269	0.245	0.237
16	U_1	0.946	0.987	1.008	1.005	0.931	1.054
17	U_2	1.221	1.291	1.315	1.263	1.404	1.441
18	U_3	2.520	1.135	1.166	2.583	1.218	1.295
19	U_4	1.652	2.630	0.890	1.759	2.840	1.001
20	U_5	1.868	2.320	2.130	1.798	2.254	2.042
21	U_6	2.978	1.495	1.102	2.821	1.454	1.056
22	U_7	1.501	2.634	3.040	1.545	2.566	2.578
23	SE	4.840	4.740	4.640	4.836	4.728	4.486

LF, FF, MF   – kg/h

TS, TF, TC   – $^{\circ}C$

U   – kW/m^2K

An attempt was made to utilize observed   data from
the evaporation plants of three paper mills. However, record
observations of pressure and vacuum gages, and liquor tempera-
tures did not match even approximately indicating malfunction-
ing of plant instrumentation. In some cases observed plant
data are inadequate for simulation studies. The program
MEEDS can be easily adopted to any evaporation plant, using
reliable observed plant data. It should be possible to obtain
the latter from a modern evaporation plant with well maintained
process control and instrumentation facility.

CHAPTER 6

SALIENT FEATURES OF MEEDS AND RECOMMENDATIONS

6.1 Special Features:

The general computer program 'MEEDS' developed in this work can be used for process design and simulation of complex evaporation plants. The program is written in FORTRAN IV and can be used on both IBM-7044 and IBM-370. The program consists of about 1700 punch cards and requires about 13000 thirty-six-bit words of core memory.

MEEDS can be used for process engineering calculations of any evaporation plant. Some of the special features and capabilities of the present model used in MEEDS are summarized below.

1. Handles any evaporation plant with following flexibilities and facilities.

    (i) Any type of evaporator (standard, LTV, FC)

    (ii) Any number of effects

    (iii) Any type of process liquor

    (iv) Weak process liquor feed to any one or more effects

    (v) Forward, reverse or mixed pattern for liquor flow

    (vi) Two-tube passes in the first effect (twin-
body evaporator effect).

  (vii) Integral liquor preheaters in effects with
backward feed liquor flow arrangement.

 (viii) One or more liquor flash tanks

   (ix) Condensate flash tanks for fresh steam condensate
from first effect

    (x) Foul condensate flashing for heat recovery

   (xi) Finisher effect for the final concentration

  (xii) Finisher condensate flash tanks for steam
condensate from finisher effect.

 (xiii) Vapor bleed from any effect

2. Useful for different constraints on heat transfer
surface of the effects in design calculations.

3. Includes integral heaters with specified area
or temperature differential approach.

4. Accounts for radiation heat losses from the
system.

5. Determines the steam consumption and heat
transfer surface requirements in design
problems.

6. In simulation studies, based on observed data,
either computes the values of overall heat
transfer coefficient and steam requirements or
predicts changes in plant performance and steam

consumption resulting from any one or more

of the following factors.

(i)   Fluctuations in input parameters like

steam pressure, feed conditions, product

concentration and vacuum.

(ii) Bypassing one of the effects for maintenance

purposes.

(iii) Modifying the existing evaporation plant for

improving performance and steam economy

7. Easy format of data input.

8. Easy output format giving complete mass and

energy balance for evaporation plant (flow rate,

concentration, enthalpy and temperature of each

stream liquor/vapor/condensate).

9. Requires 3-14 iterations in general.

10. Requires computer time of 1-15 s.

The program MEEDS in the present form has some minor
limitations which are given below; these can be very easily
accommodated by slight modifications in the computation
model.

1. MEEDS can handle at a maximum, twenty effects,

ten liquor flash tanks, ten condensate flash

tanks, twenty integral heater, twenty vapor bleed

points, one finisher and ten finisher condensate

flash tanks [Additional space can be reserved in the dimension statements for all related subscripted variables if necessary for any of the above].

2. MEEDS in the present form is adaptable for plants having two-tube passes in the first effect only. Slight modifications are necessary for plants having two-tube passes the first two effects or in the second effect alone.

3. It is assumed that heat transfer coefficients are independent of temperature, concentration and flow rate of liquor and other parameters over the range of interest in each effect. It is desirable to develop a reliable correlation for the heat transfer coefficients which can be used as a subroutine in MEEDS.

6.2 Recommendations:

Versatility of the program MEEDS for both design and simulation of any evaporation plant can be further extended to optimize the important variables like total area, steam requirement, capital cost, operating cost and number of effects.

REFERENCES

1. Honig, P., 'Principles of Sugar Technology', Elsevier, New York (1963).

2. Gudmundson, C., Svensk Papperstidning, 75(22), 901 (1972).

3. Ray, H.S. and Carnahan, F.L., Trans. Am. Inst. Chem. Engrs., 41, 253 (1945).

4. Bonilla, C.F., Trans. Am. Inst. Chem. Engrs., 41, 529 (1945).

5. Hassett, N.J., Ind. Chemist, 33, 331 (1957).

6. Wise, W.S., Ind. Chemist, 36, 434 (1960).

7. Oden, E.C., Chem.Engg., 74(9), 159 (1967).

8. Coates, J., Chem.Engg. Prog., 45(1), 25 (1949).

9. Skelland,A.H.P., Brit. Chem. Engg., 8, 242 (1963).

10. Itahara, S. and Stiel, L.I., I. and E.C. Process Design and Development, 5(3), 309 (1966).

11. Itahara,S. and Stiel, L.I., I. and E.C. Process Design and Development, 7(1), 6 (1968).

12. Burdett, J.W. and Holland, C.D., A.I.Ch.E. Jour., 17(5), 1080 (1971).

13. Jernquist, A., Olgard, G. and Hedstorm, B., Svensk Papperstidning, 69(15), 477 (1966).

14. Bolmstedt, U. and Gudmundson, C., Svensk Papperstidning 77(1), 27 (1974).

15. Bolmstedt, U. and Jernquist, A., Computer Aided Design, $\underline{8}$(3), 142 (1976).

16. Bolmstedt, U., Computer Aided Design, $\underline{9}$(1), 29 (1977).

17. Hirth, L.J. and Sampat, G.R., Chem.Engg. Prog.Symp. Ser., $\underline{67}$ (113), 78 (1971).

18. Smith, B.D., 'Design of Equilibrium Stage Processes', McGraw Hill, New York (1963).

19. McDonald, R.G. and Franklin, J.N., 'The Pulping of Wood', Vol. 1, McGraw Hill, New York (1969).

20. Kern, D.Q., 'Process Heat Transfer', McGraw Hill, New York (1950), [a] Example (14.2), p.412, [b] Example (14.3), p. 414, [c] Example (14.5), p. 427, [d] Example (14.4), p. 418, [e] Fig. (14.34b), p. 420.

21. Libby, C.E., 'Pulp and Paper Science and Technology', Vol. 1, McGraw Hill, New York (1962).

22. Badger,W.L. and Banchero, J.T., 'Introduction to Chemical Engineering', McGraw Hill, New York (1955), [a] Example (5.5), p. 231, [b] Example (5.6), p.236, [c] Problem (5.2), p. 243.

23. McCabe, W.L. and Smith,J.C. 'Unit Operations of Chemical Engineering', McGraw Hill, New York (1956), [a] Example (16.4), p. 468, [b] Problem (16.7), p.476.

24.   Coat s, G.S., TAPPI, $\underline{56}$(4), 124 (1973).

25.   Koorse, G.M., M.Tech. Thesis, Indian Institute of
        Technology, Kanpur (1972).

26.   Subroutine 'MATINV', Computer Centre Library, Indian
        Institute of Technology, Kanpur.

APPENDIX A

DESIGN ANALYSIS OF EVAPORATION PLANTS HAVING TWO-TUBE
PASSES IN SOME OF THE EFFECTS

Evaporator with two tube passes will be similar to two single effects in series with same calendria steam temperature and operating at the same pressure and having one interstream (liquor line) as shown in Fig. (A-1). The degrees of freedom for the single-effect-twin body evaporator can be calculated by equation (A-1).

$$N_f = [2(C+6) - (C+2)-2] = C+8 \qquad (A.1)$$

Specifications of feed, T or P of the body and the steam and U or A for both the bodies will require $(C+6)$ degrees of freedom. The remaining two degrees of freedom may be utilized for S_1 and S_2 or V_1 and V_2 or the area ratio between two bodies and the product liquor concentration for design case or U for both bodies in the simulation case.

For a 2-effect-3-body evaporation plant, evaporator units shown in Fig. (A-1) and Fig. (3-1) are connected in series with two interstreams (vapor and liquor lines). The degrees of freedom for this plant based on earlier analysis will be $[(C+8) + (C+6) - (C+4)] = (C+10)$.

Extension of the above analysis to a N-effect-n-body evaporation plant, gives equation (A-2) for degrees of freedom
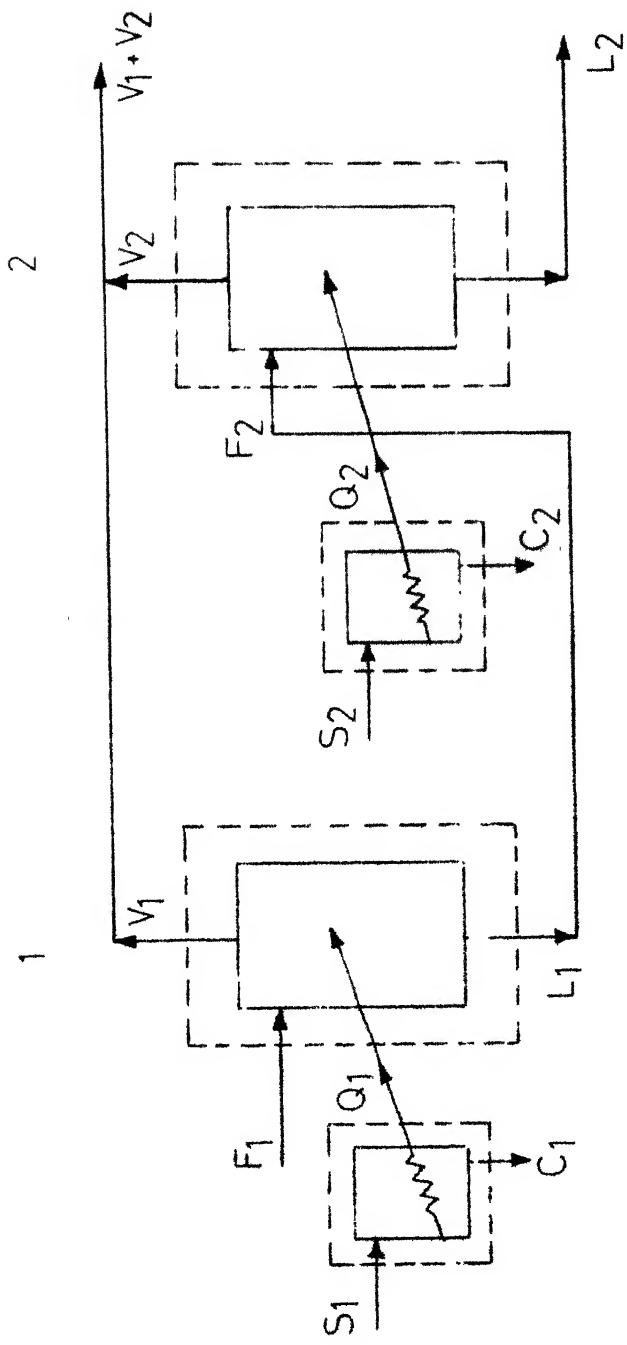
Fig. A.1 - Single effect two body evaporator

of the plant.

$$N_f = [(n-N)(C+8)] - [(n-N-1)(C+4)] + [N-(n-N)](C+6)$$

$$-[N-(n-N)](C+4) + 2$$

$$= (n-N)(C+8) + (2N-n)(C+6) + (N-1)(C+4) + 2$$

$$= C + 2n + 6 \qquad\qquad (A.2)$$

The above analysis can be further extended to give equation (A.3) for degrees of freedom of N-effect-n-body evaporation plant with liquor flash tanks (N_1), fresh steam condensate flash tanks (N_2), integral heaters (N_3), feed streams (N_4), vapor bleed points (N_5), finishers (N_6) and finisher steam condensate flash tanks with inclusion of the effect of BPR of the process liquor.

$$N_f = N_4(C+2) + 3n + N_1 + 2N_3 + N_5 + 4N_6 + 11$$

$$(A.3)$$

These degrees of freedom may be utilized in the different specifications similar to the discussions in Chapter 3, with the necessary modifications for evaporator unit having two tube passes.

APPENDIX B

SUBROUTINES/FUNCTION SUBPROGRAMS USED IN MEEDS

In this section the different subroutines/subprograms used in the program MEEDS for various purposes are discussed in detail.

1. **STEAMH:**

This function subprogram providing the enthalpy of saturated steam in kJ/kg as a function of temperature is the same as the one used by Hirth and Sampat [17]. The constants in the empirical relation used is for the range of 35-200°C.

2. **CONDEN:**

This function subprogram evaluating the enthalpy of condensate in kJ/kg as a function of temperature is also the same as used by Hirth and Sampat. [17]. The constants in the empirical relation are applicable over the range of 35-200°C.

3. **SPHTN:**

This subroutine computes values of the specific heat of different liquor streams in kJ/kg K using an empirical relation, and varies with liquor characteristics.

For bamboo kraft black liquor, the following relation developed by Koorse [25] is used.

$$(C_p)_i = 4.1868[(0.993-1.26(X_i)) + (0.0000556 + 0.0104(X_i)(T_i))]$$

$$(B.1)$$

where

(C_p) — specific heat

X — concentration

T — temperature

i — subscript for ith liquor stream

For sugar solution, the following relation is developed based on the data given in Kern [20e] assuming that temperature effects are small.

$$(C_p)_i = 4.1868 \, [1-0.55(X_i)] \tag{B.2}$$

4. SPHT1:

This subroutine calculates value of specific heat of only one liquor stream at a time using the same empirical relation used in subroutine SPHTN.

5. BPRN:

This subroutine evaluates values of boiling point rise of different liquor streams in $^{\circ}$C using an empirical relation. The relationship to be used will depend upon the physico-chemical characteristics of the liquor.

The boiling point rise of kraft black liquors at different concentrations given by Koorse are reproduced in Table (B-1) [25].

TABLE (B-1): BOILING POINT RISE VS CONCENTRATION FOR
SPENT LIQUOR

S.No.	Concentration, X	BPR, $^\circ$C
1	0.10	0.278
2	0.15	1.139
3	0.20	2.000
4	0.25	2.840
5	0.30	3.721
6	0.35	4.610
7	0.40	5.445
8	0.45	6.345
9	0.50	7.220
10	0.55	8.105

The following relation was developed by regression analysis using the above data.

$$(BPR)_i = 0.5555 \left[-2.57709 + 30.7781 \, (X_i) + 1.49186 \, (X_i)^3 \right] \qquad (B.3)$$

6. **BPR1:**

This subroutine calculates value of boiling point rise of only one liquor stream using same relation used in subroutine BPRN.

7. MATINV:

This subroutine gives the solution of simultaneous equations using Gauss–Jordon method with maximum pivot strategy [26].

The listing for all the subroutines/subprograms for the process calculations of evaporation plant handling kraft black liquor are given in the following pages.

```
      FUNCTION STEAMH(T)
------------------------------------------------------------
      THIS FUNCTION PROVIDES THE ENTHALPY OF SATURATED STEAM IN KJ/KG.
      AS A FUNCTION OF TEMPERATURE(T).
      RANGE OF THE CONSTANTS IN THE EMPIRICAL RELATION USED IS
      35-200 DEGREES C.
------------------------------------------------------------
      IF(T-100.) 10,10,20
10    STEAMH=(-0.17895872E-05*(1.8*T+32.)**3+0.54074824E-03*
     1 (1.8*T+32.)**2+0.37683630E+00*(1.8*T+32.)+C.10631549E+04)*2.326
      RETURN
20    STEAMH=(-0.12379564E-05*(1.8*T+32.)**3+0.49482426E-03*
     1 (1.8*T+32.)**2+0.32707798E+00*(1.8*T+32.)+0.10705179E+04)*2.326
      RETURN
      END




      FUNCTION CONDEN(T)
------------------------------------------------------------
      THIS FUNCTION PROVIDES THE ENTHALPY OF CONDENSATE IN KJ/KG.
      AS A FUNCTION OF TEMPERATURE(T).
      RANGE OF THE CONSTANTS IN THE EMPIRICAL RELATION USED IS
      35-200 DEGREES C.
------------------------------------------------------------
      IF(T-100.) 10,10,20
10    CONDEN=(0.29028172E-06*(1.8*T+32.)**3-0.88532687E-04*
     1 (1.8*T+32.)**2+0.10065609E+01*(1.8*T+32.)-0.32098929E+02)*2.326
      RETURN
20    CONDEN=(+0.49730691E-06*(1.8*T+32.)**3-0.25755408E-03*
     1 (1.8*T+32.)**2+0.10503794E+01*(1.8*T+32.)-0.35775445E+02)*2.326
      RETURN
      END
```

```
SUBROUTINE SPHTN(S,X,T,N)
--------------------------------------------------------------------
THIS SUBROUTINE PROVIDES VALUES OF THE SPECIFIC HEAT OF LIQUOR
IN KJ/KG*DEGREE K. USING AN EMPIRICAL RELATION.
     S - SPECIFIC HEAT OF THE LIQUOR.
     X - MASS FRACTION OF THE LIQUOR.
     T - TEMPERATURE OF THE LIQUOR.
     N - NUMBER OF VALUES OF SPECIFIC HEAT TO BE COMPUTED.
--------------------------------------------------------------------
     DIMENSION S(N), X(N), T(N)
     DO 10 I=1,N
     S(I)=((0.993-1.26*X(I))+(0.0000556+0.0104*X(I))*T(I))*4.1868
 10  CONTINUE
     RETURN
     END




     SUBROUTINE SPHT1(S,X,T)
--------------------------------------------------------------------
THIS SUBROUTINE PROVIDES ONLY ONE VALUE OF SPECIFIC HEAT OF
LIQUOR USING THE SAME EMPIRICAL RELATION.
--------------------------------------------------------------------
     S=(0.993-1.26*X+(0.0000556+0.0104*X)*T)*4.1868
     RETURN
     END
```

```
      SUBRCUTINE BPRN(B,X,N)
---------------------------------------------------------------
      THIS SUBRCUTINE PROVICES VALUES OF THE BOILING POINT RISE IN THE
      LIGUCR IN DEGREES C. USING AN EMPIRICAL RELATION.
           E - BCILING PCINT RISE.
           X - MASS FRACTICN CF THE LIQUCR.
           N - NUMBER CF VALUES OF BOILING POINT RISE TO BE CCMPUTED.
---------------------------------------------------------------
      DIMENSICN B(N), X(N)
      DO 1C I=1,N
  1C  B(I) =(-2.57709+3C.7781*X(I)+1.49186*X(I)**3)/1.8
      RETURN
      END
```

```
      SUBRCUTINE BPRI(B,X)
---------------------------------------------------------------
      THIS SUBRCUTINE PROVICES CNLY ONE VALUE OF BOILING POINT RISE
      USING THE SAME EMPIRICAL RELATICN.
---------------------------------------------------------------
      B =(-2.57709+30.7781*X+1.49186*X**3)/1.8
      RETURN
      END
```

```
      SUBROUTINE MATINV(A,N,B,M,DETERM)
C-------------------------------------------------------------------
C     THIS SUBROUTINE PROVIDES THE SOLUTION OF SIMULTANEOUS EQUATIONS
C     USING GAUSS JORDEN METHOD WITH MAXIMUM PIVOT STRATEGY.
C     THE DUMMY VARIBLES REPRESENT
C         A - COEFFICIENT MATRIX OF SIZE N.
C         B - CONSTANT VECTOR OF SIZE N.
C         M - NUMBER OF CONSTANT VECTORS.
C         DETERM - VALUE OF DETERMINANT RETURNED BY THE ROUTINE.
C-------------------------------------------------------------------
      DIMENSION A(20,20), B(20,1), IPIVOT(40), INDEX(40,2)
      EQUIVALENCE (IROW,JROW), (ICOLUM,JCOLUM), (AMAX, T, SWAP)
C     INITIALIZATION.
   10 DETERM=1.
   15 DO 20 J=1,N
   20 IPIVOT(J)=0
C     SEARCH FOR PIVOT ELEMENT.
   30 DO 550 I=1,N
   40 AMAX=0.
   45 DO 105 J=1,N
   50 IF(IPIVOT(J)-1) 60, 105, 60
   60 DO 100 K=1,N
   70 IF(IPIVOT(K)-1) 80, 100, 780
   80 IF(AMAX-ABS(A(J,K) ) ) 85, 100, 100
   85 IROW=J
   90 ICOLUM=K
   95 AMAX=ABS(A(J,K))
  100 CONTINUE
  105 CONTINUE
      IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1
C     INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL.
      IF(IROW-ICOLUM) 140, 260, 140
  140 DETERM=-DETERM
  150 DO 200 L=1,N
  160 SWAP=A(IROW,L)
  170 A(IROW,L)=A(ICOLUM,L)
  200 A(ICOLUM,L)=SWAP
  205 IF(M) 260, 260, 210
  210 DO 250 L=1,M
  220 SWAP=B(IROW,L)
  230 B(IROW,L)=B(ICOLUM,L)
  250 B(ICOLUM,L)=SWAP
  260 INDEX(I,1)=IROW
  270 INDEX(I,2)=ICOLUM
C     DIVIDE PIVOT ROW BY PIVOT ELEMENT.
  310 PIVOT=A(ICOLUM,ICOLUM)
  320 DETERM=DETERM*PIVOT
  330 A(ICOLUM,ICOLUM)=1.0
  340 DO 350 L=1,N
  350 A(ICOLUM,L)=A(ICOLUM,L)/PIVOT
  355 IF (M) 380, 380, 360
  360 DO 370 L=1,M
  370 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT
```

```
REDUCE NON-PIVOT ROWS.
DO 550 L1=1,N
IF(L1-ICOLUM) 400, 550,400
T=A(L1,ICOLUM)
A(L1,ICOLUM)=0.
DO 450 L=1,N
A(L1,L)=A(L1,L)-A(ICOLUM,L)*T
IF (N) 550,550,460
DO 500 L=1,N
B(L1,L)=B(L1,L)-B(ICOLUM,L)*T
CONTINUE
INTERCHANGE COLUMNS.
DO 710 I=1,N
L=N+1-I
IF(INDEX(L,1)-INDEX(L,2)) 630, 710, 630
JROW=INDEX(L,1)
JCOLUM=INDEX(L,2)
DO 705 K=1,N
SWAP=A(K,JROW)
A(K,JROW)=A(K,JCOLUM)
A(K,JCOLUM)=SWAP
CONTINUE
CONTINUE
DO 740 K=1,N
IF(IPIVOT(K).NE.1) GO TO 760
CONTINUE
RETURN
WRITE (6,770)
FORMAT(/30X*MATRIX IS SINGULAR*/)
RETURN
END
```

APPENDIX   C

LISTING OF MEEDS

```
C
C
C*********************************************************************
C        A PROGRAM FOR THE DUAL PURPOSE OF DESIGN OR SIMULATION OF
C        MULT.PLE EFFECT EVAPORATOR PLANT.
C*********************************************************************
C
C        PROGRAM HANDLES ANY NUMBER OF EVAPORATORS UP TO 20 IN ANY
C        COMBiNATION WITH OR WITHOUT FINISHER EFFECT FOR THE FINAL
C        CONCENTRATION.
C
C        THE FIRST EFFECT TO WHOSE STEAM CHEST THE FRESH STEAM IS FED MAY
C        HAVE EITHER TWO TUBE PASSES (THAT IS TWC BODIES-1A AND 1B) OR
C        CONVENTIONAL SINGLE PASS.
C
C        WEAK LIQUOR CAN BE FEC THROUGH SINGLE OR PARALLEL FEEDING
C        CONCEPT WITH OR WITHOUT MULTIPLE FEED STREAMS. WHEN FEED IS
C        FED AS SINGLE STREAM TO ANY BODY, IT IS SINGLE FEEDING CONCEPT.
C        WHEN FED IN PARALLEL TO TWO BODIES ANC CONCENTRATED LIQUOR
C        PRODUCT FROM BOTH ARE COMBINEDLY FED TO SOME OTHER BODY, IT IS
C        SAID TO FOLLOW PARALLEL FEEDING CONCEPT. MULTIPLE FEED STREAMS
C        ARE SOME OF THE FRACTIONS OF THE FEED FED TO DIFFERENT BODIES
C        ALONG WITH THE LIQUOR PRODUCTS FROM OTHER BODIES.
C
C        THE LIQUOR MAY FOLLOW FORWARD, BACKWARD OR MIXED FLOW PATTERN.
C
C        BLEEDING OF VAPORS FROM ANY BODY FOR CIFFERENT PURPOSES CAN BE
C        HANDLED.
C
C        ANY OR ALL HEAT RECOVERY FEATURES LIKE ONE OR MORE LIQUOR FLASH
C        TANKS, CONDENSATE FLASH TANKS (FOR FRESH STEAM CONDENSATE FROM
C        FIRST EFFECT AND FINISHER EFFECTS AND FCUL CONDENSATE FROM OTHER
C        EFFECTS) CAN BE INCLUCED.
C
C        ANY NUMBER OF INTEGRAL HEATERS ONE EACH IN DIFFERENT BODIES FOR
C        THE LIQUOR FEED PREHEATING CAN BE INCLUCED WITH SPECIFIED AREA
C        OR TEMPERATURE APPROCH.
C
C        HEAT LOSSES FROM THE SYSTEM CAN BE ACCOUNTED.
C
C        IN DESIGN CASE
C        THE PROGRAM DETERMINES HEAT TRANSFER AREAS OF THE EVAPORATORS,
C        INTEGRAL HEATERS AND FINISHER EFFECT.
C
C        IN S MULATION CASE
C        THE PROGRAM CAN HANDLE TWO DIFFERENT CASES. IN FIRST CASE THE
C        PROGRAM DETERMINES HEAT TRANSFER COEFFICIENTS ON FEEDING AREAS
C        OF HEAT TRANSFER ALONG WITH TEMPERATURES DROPS FOR ANY EXISTING
C        PLANT. IN OTHER CASE, PROGRAM CHECKS THE PERFORMANCE ON FEEDING
C        AREAS OF HEAT TRANSFER WITH HEAT TRANSFER COEFFICIENTS OF ALL
C        EVAPORATORS.
C
C        PROGRAM OUTPUT PROVIDES COMPLETE MASS AND ENERGY BALANCES FOR
C        THE EVAPORATOR PLANT (FLOW RATE, CONCENTRATION, ENTHALPY,
C        TEMPERATURES ETC. FOR EACH STREAM LIQUOR/VAPOR/CONDENSATE).
C
C        PROGRAM DETERMINES THE STEAM REQUIRED TC BE FED TO FIRST EFFECT,
C        AMOUNTS OF STEAM UTILIZED BY EACH OF ITS BODIES, STEAM REQUIRED
C        IN FINISHER EFFECT ANC THE STEAM ECONCMY OF THE PLANT.
C
```

```
C************************************************************************
C          ALL TEMPERATURES ARE IN DEGREES CENTIGRADE.
C          ALL ENTHALPIES ARE IN KILOJOULES/KG.
C          ALL SPECIFIC HEATS ARE IN KJ/KG*DEGREE C.
C          ALL FLOW RATES ARE IN KGS/HOUR.
C          AA      = AREA OF HEATING SURFACE OF THE BODY,  M**2.
C          U       = OVERALL HEAT TRANSFER COEFFICIENT OF THE BODY,
C                    KW/M**2*DEGREE C.
C          Q       = RATE OF HEAT TRANSFER,  KW.
C          NEFF    = THE NUMBER OF EFFECTS.
C          NBODY   = THE NUMBER OF BODIES.
C          NLFT    = THE NUMBER OF LIQUOR FLASH TANKS.
C          NCFT    = THE NUMBER OF CONDENSATE FLASH TANKS.
C          NIH     = THE NUMBER OF INTEGRAL HEATERS.
C          FF      = FEED FRACTION FLOW RATES.
C          HFF     = ENTHALPY OF THE FEED FRACTION.
C          V       = FLOW RATE OF VAPOR.
C          LOUT    = FLOW RATE OF LIQUOR OUT.
C          XLOUT   = MASS FRACTION OF LIQUOR OUT.
C          TC      = TEMPERATURE OF CONDENSATE.
C          TIN     = TEMPERATURE OF LIQUOR IN.
C          TOUT    = TEMPERATURE OF LIQUOR OUT.
C          DT      = WORKING TEMPERATURE POTENTIAL.
C          BPRISE  = BOILING POINT RISE.
C          HV      = ENTHALPY OF THE VAPOR.
C          HLIN    = ENTHALPY OF THE LIQUOR IN.
C          HLOUT   = ENTHALPY OF THE LIQUOR OUT.
C          SPHT    = SPECIFIC HEAT OF THE LIQUOR.
C          VBLEED  = BLEED VAPOR STREAM RATE.
C          QBLEED  = HEAT OF BLEED VAPOR STREAM.
C
C          IH      = INTEGRAL HEATER.
C          UIH     = OVERALL HEAT TRANSFER COEFFICIENT OF IH.
C          AAIH    = AREA OF HEATING SURFACE OF IH.
C          QIH     = RATE OF HEAT TRANSFER IN IH.
C          TIHIN   = TEMPERATURE OF THE LIQUOR IN TC IH.
C          TIHOUT  = TEMPERATURE OF THE LIQUOR OUT FROM IH.
C          DTIH    = TEMPERATURE DIFFERENCE BETWEEN OUTGOING AND
C                    INCOMING LIQUOR TO THE IH.
C
C          LFT     = LIQUOR FLASH TANK.
C          VLFT    = VAPOR FLOW RATE FROM LFT.
C          LLFTO   = LIQUOR OUT FROM LFT.
C          XLLFTO  = MASS FRACTION OF LIQUOR OUT FROM LFT.
C          TLFTO   = TEMPERATURE OF LIQUOR OUT FROM LFT.
C          HLLFTO  = ENTHALPY OF LIQUOR OUT FROM-LFT.
C          SPHLFT  = SPECIFIC HEAT OF LIQUOR OUT FROM LFT.
C          BPRLFT  = BOILING POINT RISE IN LFT.
C          HVLFT   = ENTHALPY OF VAPOR FROM LFT.
C
C          CFT     = CONDENSATE FLASH TANK.
C          VCFT    = VAPORS FLOW RATE FROM CFT.
C          CCFTO   = CONDENSATE OUT FROM CFT.
C          HVCFT   = ENTHALPY OF VAPOR FROM CFT.
C          HCCFTO  = ENTHALPY OF CONDENSATE OUT FROM CFT.
C
C          FIN     = FINISHER EFFECT.
C          UFIN    = OVERALL HEAT TRANSFER COEFFICIENT OF FIN.
C          AAFIN   = AREA OF HEATING SURFACE OF FIN.
C          QFIN    = RATE OF HEAT TRANSFER IN FIN.
```

```
C    VFIN     = VAPOR FLOW RATE FROM FIN.
C    LFINO    = LIQUOR OUT FROM FIN.
C    XLFINO   = MASS FRACTION OF LIQUOR OUT FRCM FIN.
C    TFINO    = TEMPERATURE OF LIQUOR OUT FRCM FIN.
C    HLFINO   = ENTHALPY OF LIQUOR OUT FROM FIN.
C    SPHFIN   = SPECIFIC HEAT OF LIQUCR OUT FRCM FIN.
C    BPRFIN   = BOILING POINT RISE IN FIN.
C    HVFIN    = ENTHALPY OF VAPOR FROM FIN.
C    DTFIN    = TEMPERATURE POTENTIAL IN FIN.
C
C    FCFT     = FINISHER CONDENSATE FLASH TANK.
C    VFCFT    = VAPOR FLOW RATE FROM FCFT.
C    CFCFTO   = CONDENSATE OUT FROM FCFT.
C    HVFCFT   = ENTHALPY OF VAPOR FROM FCFT.
C    HCFFTO   = ENTHALPY OF CONDENSATE OUT FROM FCFT.
C
C************************************************************************
   10 CONTINUE
      DIMENSION AA(20), U(20), Q(20), V(20), XLOUT(25)
      DIMENSION A(20,20), B(20,1), AX(20,20), BX(20,1)
      DIMENSION SABONE(2), FF(2), HFF(2), IFSCRD(2)
      DIMENSION NORD(20), IFEED(25), NLORD(10), NCORD(10), NFCORD(10)
      DIMENSION TC(25), TIN(25), TOUT(20), TIHIN(20), TIHOUT(20)
      DIMENSION HC(20), DT(20), DTIH(20), BPRISE(20), BPRLFT(10)
      DIMENSION HLIN(20), HLOUT(20), HV(20), SPHT(20), SPHLFT(10)
      DIMENSION R(20), NAA(20), QBLEED(20), VBLEED(20), RBLEED(20)
      DIMENSION XLLFTO(10), TLFTO(10), VLFT(10), HVLFT(10), HLLFTO(10)
      DIMENSION CCFTO(10), VCFT(10), HCCFTO(10), HVCFT(10)
      DIMENSION CFCFTO(10), VFCFT(10), HCFFTO(10), HVFCFT(10)
      DIMENSION UIH(20), AAIH(20), QIH(20), IIH(20)
      REAL LOUT(25), LLFTO(10), MFEED(20)
      REAL LADD, LINTER, LFINO
C     NPLANT IS THE NUMBER CF PLANT DATA-SETS SUPPLIED.
      READ(5,3000) NPLANT
C     SPECIFY CONTROL INDEX.
      IPLANT=1
   20 CONTINUE
C     READ NUMBER OF EFFECTS, NUMBER OF BODIES, NUMBER OF LIQUOR AND
C     CONDENSATE FLASH TANKS, NUMBER OF INTEGRAL HEATERS.
      READ(5,3000) NEFF,NBODY,NLFT,NCFT,NIH
C     NBODY1 IS A SUBSCRIPT UTILIZED TO REPRESENT THE PROPERTIES OF
C     THE FEED SOLUTION - TEMPERATURE, MASS FRACTION AND FLOW RATE.
      NBODY1=NBODY+1
C     NBODY2 IS A SUBSCRIPT UTILIZED TO REPRESENT THE PROPERTIES OF
C     THE FINAL PRODUCT FROM THE SYSTEM.
      NBODY2=NBODY+2
      NBODY3=NBODY+3
      IBODY=NBODY-1
      IBODY1=IBODY-1
      KBODY=IBODY
C     SPECIFY CONTROL INDICES.
      ICONV=0
      CFT1=0
C     IAB1 IS THE COUNTER WHICH IS EQUAL TO 1 WHEN FIRST EFFECT HAS
C     TWO BODIES AND EQUALS 0 IF IT HAS NOT.
      READ(5,3000) IAB1
      IF(IAB1.EQ.1) GO TO 30
      IBODY=IBODY+1
      IBODY1=IBODY1+1
   30 CONTINUE
C     IFINI IS THE CFUNTER WHICH IS EQUA3 -C 1 WHEN PLANT HAS FINI HE9
```

```
C       EFFECT AND EQUALS 0 IF IT HAS NOT.
        READ(5,3000) IFINI                                          (4)
C       IPFS=1 IMPLIES THAT FEED IS FED THROUGH SINGLE FEEDING CONCEPT
C       WITH OR WITHOUT MULTIPLE FEED STREAMS. IPFS=2 IMPLIES THAT
C       PARALLEL FEEDING CONCEPT WITH OR WITHOUT MULTIPLE FEED STREAMS
C       IS USED.
        READ(5,3000) IPFS
C       THE EVAPORATORS IN THEIR SERIES IN THE PLANT ARE NUMBERED
C       ACCORDING TO THE DIRECTION OF THE STEAM FLOW. THE BODY RECIEVING
C       THE FRESH INPUT STEAM IS NUMBERED 1 AND THE BODY WHOSE STEAM
C       CHEST RECIEVES THE VAPORS FROM FIRST BODY IS NUMBERED 2 AND SO
C       ON.  F FIRST EFFECT HAS TWO BODIES, FIRST BODY IS NUMBERED 1,
C       THE OTHER BODY 2, AND THEN THE BODY 9ECIEVING THE VAPORS OF
C       THESE BODIES FOR THEIR HEAT UTILIZATION IS NUMBERED 3 AND SO ON.
C       WITH THIS NUMBERING THE ARRAYS NORD, IFEED AND IFSORD ARE
C       DEFINED AS FOLLOWS. NORD(I)=N  IMPLIES THAT BODY N IS THE ITH
C       BODY TO RECIEVE THE SOLUTION TO BE EVAPORATED. IFSORD(I)=N
C       IMPLIES THAT ITH BODY IS RECIEVING LIQUOR FROM BODY N EXCEPT
C       WHEN N IS GREATER THAN NBODY. WHEN N EQUALS NBODY1 THEN THIS IS
C       THE BODY RECIEVING INITIAL FEED FRACTION. WHEN IPFS=2 THEN N CAN
C       BE NBODY3 WHICH INDICATES THAT THIS IS THE BODY RECIEVING THE
C       LIQUOR OUT FROM BOTH THE BODIES RECIEVING INITIAL FEED FRACTIONS
C       IFSORD(I)=N  IMPLIES THAT N IS THE ITH BODY RECIEVING INITIAL
C       FEED FRACTIONS.
        READ(5,3000) (NORD(I), I=1,NBODY), (IFEED(I), I=1,NBODY),
       1(IFSORD(I), I=1,IPFS)
C       LBODY REPRESENTS THE LAST BODY RECIEVING THE LIQUOR IN THE
C       SERIES OF EVAPORATORS.
        READ(5,3000) LBODY
        IF(NLFT.EQ.0   .AND.   IFINI.EQ.0) NBODY2=LBODY.
C       FEEDPS IS THE FRACTION OF FEED FED THROUGH SINGLE OR PARALLE3
C       FEEDING CONCEPT EXCLUDING MULTIPLE FEED STREAMS.
C       READ THE MASS FRACTION OF FEED, THE MASS FRACTION OF THE FINAL
C       PRODUCT AND FEEDPS.
        READ(5,3010) XLOUT(NBODY1),XLOUT(NBODY2),FEEDPS
        XLBODY=XLOUT(NBODY2)
C       X  IS THE FRACTION OF FEEDPS THAT GOES TO BODY IFSORD(1).
        READ(5,3010) X
        Y=1.0-X
C       FF(I)  IS THE FEED TO BODY IFSORD(I).
        FF(1)=X*FEEDPS
        FF(2)=Y*FEEDPS
C       MFEED(I) REPRESENTS THE MULTIPLE FEED STREAM TO ITH BODY.
C       TMFEED IS THE TOTAL FEED THROUGH MULTIPLE FEED STREAMS.
C       MFEED IS ZERO FOR THE BODIES WHICH ARE LISTED IN IFSORD ARRAY.
        TMFEED=0.
        READ(5,3010) (MFEED(I),I=1,NBODY)
        DO 40 I=1,NBODY
   40   TMFEED=TMFEED+MFEED(I)
C       LOUT(NBODY1)  IS THE TOTAL FEED TO THE PLANT.
        LOUT(NBODY1)=FEEDPS+TMFEED
   50   CONTINUE
C       READ THE TEMPERATURE OF THE FRESH INPUT STEAM,FEED AND THE LAST
C       BODY VAPOR CONDENSATE.
        READ(5,3010) TS,TIN(NBODY1),TC(NBODY1)
C       CALCULATE THE ENTHALPY OF THE SATURATED FRESH INPUT STEAM.
        HS=STEAMH(TS)
C       ASSUMING THE FRESH INPUT STEAM IS SATURATED, TC=TS.
        TC(1)=TS
C       CALCULATE THE ENTHALPY OF THE FRESH STEAM CONDENSATE FROM FIRST
C       BODY.
```

```
      HC(1)=CONDEN(TS)
      IF(IAB1.EQ.0) GO TO 6C
C     THE TEMPERATURE AND ENTHALPY OF CONDENSATE FROM SECOND BODY WILL
C     BE SAME AS THAT FROM FIRST BODY, WHEN IAB1=1.
      TC(2)=TC(1)
      HC(2)=HC(1)
   60 CONTINUE
      XLF=XLOUT(NBODY1)
      TF=TIN(NBODY1)
C     CALCULATE THE SPECIFIC HEAT OF FEED STREAM.
      CALL SPHT1(SPHTF,XLF,TF)
C     CALCULATE THE ENTHALPY OF FEED STREAMS.
      DO 70 I=1,IPFS
   70 HFF(I)=SPHTF*TF
C     HMFEED IS THE ENTHALPY OF THE MULTIPLE FEED STREAMS.
      HMFEED=SPHTF*TF
   80 CONTINUE
C     IBLEED IS THE COUNTER SPECIFYING THE BLEEDING FACILITY.
C     IF IBLEED=1 IT IS AVAILABLE, AND IF EQUALS 0 IT IS NOT.
      READ(5,3000) IBLEED
      IF(IBLEED.EQ.0) GO TO 90
C     ICBLED=0 SIGNIFIES THAT THE CONDENSATE OF THE BLEED STREAMS ARE
C     NOT UTILIZED FOR IMPROVING THE PLANT ECONOMY BY THEIR PROPER
C     FLASHING. ICBLED=1 MEANS THEY ARE FLASHED BACK IN THE PROPER
C     STEAM CHESTS.
      READ(5,3000) ICBLED
C     READ AMOUNT OF HEAT REQUIRED QBLEED(I) FROM ITH BLEED STREAM
C     FROM ITH BODY.
      READ(5,3010) (QBLEED(I), I=1,NBODY)
   90 CONTINUE
C     DESIGN=0. SIGNIFIES THAT THE CASE OF EXISTING PLANT IS UNDER
C     CONSIDERATION AND SO HEAT TRANSFER AREAS ARE KNOWN. THE PLANT
C     IN SUCH CASE IS TO BE SIMULATED.
C     DESIGN=1. IMPLIES THAT THE PLANT IS TO BE DESIGNED.
      READ(5,3010) DESIGN
C     FCHEAT=0. IMPLIES THAT THE FOUL CONDENSATES ARE NOT FLASHED
C     SEQUENTIALLY TO UTILIZE THEIR HEATS FOR HEATING.
C     FCHEAT=1. POINTS OUT THAT THIS FACILITY IS AVAILABLE.
      READ(5,3010) FCHEAT
      IF(DESIGN.EQ.0.) GO TO 100
C     NAAC IS THE NUMBER OF AREA CONSTRAINTS UNDER WHICH THE DESIGNING
C     IS TO BE CARRIED OUT. THIS EXCLUDES THE AREA CONSTRAINT RELATING
C     AREA OF BODY(1) TO BODY(2), WHEN IAB1=1.
      READ(5,3000) NAAC
C     READ THE HEAT TRANSFER COEFFICIENTS.
      READ(5,3010) (U(I), I=1,NBODY)
      GO TO 120
  100 CONTINUE
C     ISIM=0 SIGNIFIES THE PLANT IS TO BE SIMULATED WHOSE HEAT
C     TRANSFER COEFFICIENTS OF ALL BODIES ARE NOT KNOWN BUT THE HEAT
C     TRANSFER AREAS AND TEMPERATURE DROPS OF EACH BODY ARE KNOWN.
C     ISIM=1 SIGNIFIES THE PLANT IS TO BE SIMULATED WHOSE HEAT
C     TRANSFER COEFFICIENTS AND HEAT TRANSFER AREAS ARE KNOWN AND THE
C     PERFORMANCE CHECK IS TO BE CARRIED OUT.
      READ(5,3000) ISIM
C     READ HEAT TRANSFER AREAS.
      READ(5,3010) (AA(I), I=1,NBODY)
      IF(ISIM.EQ.0) GO TO 110
C     READ HEAT TRANSFER COEFFICIENTS.
      READ(5,3010) (U(I), I=1,NBODY)
      GO TO 120
```

```
  110 CONTINUE
C     READ THE WORKING TEMPERATURE POTENTIALS.
      READ(5,3010) (DT(I), I=1,NBODY)
      IF(IAB1.EQ.0) GO TO 120
C     IFIRST IS THE BODY OF FIRST EFFECT WHCSE LIQUOR OUT IS FED TO
C     OTHER BODY OF FIRST EFFECT.
      READ(5,3000) IFIRST
C     LINTER IS THE LIQUOR CUT FRCM IFIRST THAT IS IT IS INTERMEDIATE
C     LIQUOR OF TWO BODIES CF FIRST EFFECT.
      READ(5,3010) LINTER
  120 CONTINUE
      IF(IAB1.EQ.0) GO TO 130
C     RAB1 IS THE AREA RATIC OF BODY(1) TO BOCY(2).
      READ(5,3010) RAB1
  130 CONTINUE
      IF(DESIGN.EQ.0.) GO TC 150
C     R(I) IS THE RATIO OF HEAT TRANSFER AREAS OF THE FIRST FEW BODIES
C     NAA(I) TO THAT OF BOCY (NAA(I)+1).
      READ(5,3010) (R(I), I=1,NAAC)
      DO 140 I=1,NAAC
      IF(R(I).EQ.1.) GO TO 140
      READ(5,3000) NAA(I)
  140 CONTINUE
C     RLOSS IS THE RADIATION LOSS FRACTION ASSUMED AS A FRACTION OF
C     TOTAL HEAT INPUT THROUGH FRESH INPUT STEAM, FOR ACCOLNTING ALL
C     THE HEAT LOSSES.
  150 READ(5,3010) RLOSS
C     KALBPR  IS THE COUNTER EQUAL TO 1 WHEN BOILING POINT RISES ARE
C     TO BE CALCULATED AND EQUALS 0 WHEN THEY ARE ALREADY KNOWN.
      READ(5,3000) KALBPR
      IF(KALBPR.EQ.1) GO TO 170
C     READ BOILING POINT RISES IN ALL BODIES.
      READ(5,3010) (BPRISE(I), I=1,NBODY)
      IF(NLFT.EQ.0) GO TO 160
C     READ BOILING POINT RISE IN EACH LIQUOR FLASH TANK.
      READ(5,3010) (BPRLFT(I), I=1,NLFT)
  160 IF(IFINI.EQ.0) GO TO 170
C     READ BOILING POINT RISE IN THE FINISHER EFFECT.
      READ(5,3010) BPRFIN
  170 CONTINUE
      YEFF=NEFF
      YLFT=NLFT
      YFINI=IFINI
C     CALCULATE THE FLOW RATE OF FINAL LIQUOR PRODUCT FROM THE PLANT.
      LOUT(NBODY2)=LOUT(NBOCY1)*XLOUT(NBODY1)/XLOUT(NBODY2)
C     TOTEVP IS THE TOTAL EVAPORATION IN THE PLANT.
      TOTEVP=LOUT(NBODY1)-LCUT(NBODY2)
C     FOR FIRST APPORXIMATION ASSUME EVAPORATION RATE IN EACH LFT,
C     EVPLFT, TO BE 1 PERCENT OF TOTAL EVAPCRATION.
      EVPLFT=0.01*TOTEVP
C     ASSUME EVAPORATION RATE IN THE FINISHER EFFECT, EVPFIN, TO BE 5
C     PERCENT OF TCTAL EVAPCRATION.
      EVPFIN=0.05*TOTEVP
C     FOR FIRST APPORXIMATICN ASSUME EVAPORATION RATE, EVPEFF, EQUAL
C     IN ALL NEFF EFFECTS.
      EVPEFF=(TOTEVP-YLFT*EVPLFT-YFINI*EVPFIN)/YEFF
      DO 190 I=1,NBODY
      Q(I)=1000000.0
      IF(IAB1.EQ.0) GO TO 180
      IF(I.GT.2) GO TO 180
C     SINCE FIRST EFFECT HAS TWO BODIES, THE EVAPORATION RATES IN EACH
```

```
C         BODY IS CALCULATED BASED ON THEIR AREA RATIO,RAB1.
          V(1)=EVPEFF*RAB1/(1.+RAB1)
          V(2)=EVPEFF/(1.+RAB1)
          GO TO 190
      180 V(I)=EVPEFF
      190 CONTINUE
C         IIH ARRAY IS DEFINED TO SPECIFY THE BODIES HAVING INTEGRAL
C         HEATERS.  IIH(I)=1 IMPLIES THAT ITH BODY IS HAVING INTEGRAL
C         HEATER IN IT. IIH(I)=C IMPLIES THAT ITH BODY IS NOT PROVIDED
C         WITH INTEGRAL HEATER.
          READ(5,3000) (IIH(I), I=1,NBODY)
          IF(NIH.EQ.0) GO TO 230
          DO 210 I=1,NBODY
          IF(IIH(I).EQ.0) GO TO 210
          IF(DESIGN.EQ.0.) GO TO 200
C         READ HEAT TRANSFER COEFFICIENT OF INTEGRAL HEATER.
          READ(5,3010) UIH(I)
          GO TO 210
C         READ HEATING SURFACE AREA OF INTEGRAL HEATER.
      200 READ(5,3010) AAIH(I)
      210 CONTINUE
C         IPROCH IS THE COUNTER EQUAL TO 1 WHEN PERCENT TEMPERATURE METHOD
C         IS TO BE USED FOR IH CALCULATIONS AND EQUAL TO 0 WHEN AREA
C         APPROCH METHOD IS TO BE USED.
          READ(5,3000) IPROCH
          IF(IPROCH.EQ.1) GO TO 220
          IF(DESIGN.EQ.0.) GO TO 230
C         RIH  IS THE RATIO OF AREAS OF ITH BODY INTEGRAL HEATER TO ITH
C         BODY.
          READ(5,3010) RIH
          GO TO 230
C         RIH1  IS THE RATIO INITIAL TEMPERATURE POTENTIAL (WHICH IS
C         TEMPERATURE DIFFERENCE BETWEEN INCOMING LIQUOR TO IH AND VAPOR
C         TEMPERATURE CONDENSING OUTSIDE) MINUS FINAL TEMPERATURE
C         POTENTIAL(TEMPERATURE DIFFERENCE BETWEEN LIQUOR OUT FROM IH AND
C         VAPOR TEMPERATURE OUTSIDE) DIVIDED BY INITIAL TEMPERATURE
C         POTENTIAL.
      220 READ(5,3010) RIH1
      230 CONTINUE
          IF(NLFT.EQ.0) GO TO 250
          DO 240 I=1,NLFT
      240 VLFT(I)=EVPLFT
C         NLORD(I)=J  POINTS OUT THAT VAPOR FROM ITH LIQUOR FLASH TANK
C         ENTERS THE STEAM CHEST OF BODY J.
          READ(5,3000) (NLORD(I), I=1,NLFT)
      250 CONTINUE
          IF(NCFT.EQ.0) GO TO 260
C         NCORD(I)=J  POINTS OUT THAT VAPOR FROM ITH CONDENSATE FLASH TANK
C         MOVES IN THE STEAM CHEST OF BODY J.
          READ(5,3000) (NCORD(I), I=1,NCFT)
      260 CONTINUE
          IF(IFINI.EQ.0) GO TO 290
C         NFOR  IS THE NUMBER OF LIQUOR FLASH TANKS RECIVING THE LIQUOR
C         BEFORE THE FINISHER EFFECT.
C         NVORD  IS THE BODY TO WHOSE STEAM CHEST THE VAPOR FROM FINISHER
C         ENTERS.
C         NFCFT  IS THE NUMBER CF CONDENSATE FLASH  TANKS IN WHICH THE
C         FINISHER EFFECT CONDENSATE IS FLASHED SEQUENTIALLY.
          READ(5,3000) NFOR,NVORD,NFCFT
          IFOR=NFOR+1
          IFOR1=IFOR+1
```

```
C      TSFIN IS THE TEMPERATURE OF FRESH STEAM INPUT TO FINISHER EFFECT
C      STEAM CHEST.
C      RLOSSF IS TEH RADIATICN LOSS FRACTION IN FINISHER ASSUMED AS A
C      FRACTION OF TOTAL HEAT INPUT BY FRESH STEAM INPUT FOR ACCOUNTING
C      HEAT LOSSES IN FINISHER EFFECT.
       READ(5,3010) TSFIN,RLCSSF
C      CALCULATE THE ENTHALPY OF THE STEAM INPLT TO FINISHER EFFECT,
C      ASSUMING IT TO BL SATURATED,TCFIN=TSFIN.
       HSFIN=STEAMH(TSFIN)
       TCFIN=TSFIN
C      CALCULATE THE ENTHALPY OF THE FINISHER EFFECT CONDENSATE.
       HCFIN=CONDEN(TCFIN)
       VFIN=EVPFIN
       IF(DESIGN.EQ.0.) GO TC 270
C      READ HEAT TRANSFER COEFFICINT OF FINISHER EFFECT.
       READ(5,3010) UFIN
       GO TO 280
  270 CONTiNUE
C      READ HEATING SURFACE AREA OF FINISHER EFFECT.
       READ(5,3010) AAFIN
  280 CONTiNUE
       IF(NFCFT.EQ.0) GO TO 290
C      NFCORD(I)=J POINTS OUT THAT VAPOR FROM ITH FINISHER CONDENSATE
C      FLASH TANK ENTERS THE STEAM CHEST OF BOCY J.
       READ(5,3000) (NFCORD(I), I=1,NFCFT)
  290 CONTINUE
C      NIT = NUMBER OF ITERATIONS.
C      INITiALLY NIT IS ZERO.
       N T=0
C      MAXNIT = MAXIMUM NUMBER OF ITERATIONS TC BE CARRIED OUT.
       READ(5,3000) MAXNIT
  300 CONTINUE
C      CALCULATE THE LIQUOR CUT FROM EACH BOCY AND THE MASS FRACTIONS
C      OF ALL THESE OUTGOING STREAMS.
C      SOLUTE  IS THE AMOUNT OF SOLUTE IN THE STREAM.
       SOLUTE=FEEDPS*XLOUT(NBODY1)
C      LADD IS THE SUM OF LICUORS OUT FROM BCDIES LISTED IN IFSORD
C      ARRAY.
       LADD=0.
       DO 320 I=1,IPFS
       K=IFSORD(I)
       IF(DESIGN.EQ.1.) GO TC 310
       IF(ISIM.EQ.1   .OR.   IAB1.EQ.0) GO TC 310
C      VDIFF  IS THE DIFFERENCE IN ASSUMED OR CALCULATED VAPOR FLOW
C      RATE AND EXPECTED VAPCR FLOW RATE PROVICING EXPECTED
C      INTERMEDIATE LIQUOR STREAM OF FIRST EFFECT TWO BODIES.
       VDIFF=0.
       IF(K.NE.IFIRST) GO TO 310
       LOUT(K)=LINTER
       VDIFF=V(K)-(FF(I)-LOUT(K))
       V(K)=FF(I)-LCUT(K)
  310 CONTiNUE
       XLOUT(K)=FF(I))XLOUT(NBODY1)/LOUT(K)
  320 LADD=LADD+LOUT(K)
  330 CONTiNUE
       DO 370 I=1,NBODY
       IF(IFEED(I).NE.NBODY3) GO TO 370
       IF(DESIGN.EQ.1.) GO TC 350
       IF(ISIM.EQ.1   .OR.   IAB1.EQ.0) GO TC 350
       IF(VDIFF.NE.0.) GO TO 340
       IF(I.NE.IFIRST) GO TO 350
```

```
      LOUT(I)=LINTER
      VDIFF=V(I)-(LADD+MFEEC(I)-LOUT(I))
      V(I)=LADD+MFEED(I)-LOUT(I)
      GO TO 360
  340 V(I)=V(I)+VDIFF
      VDIFF=0.
  350 CONTINUE
      LOUT(I)=LADD+MFEED(I)-V(I)
  360 CONTINUE
      SOLUTE=SOLUTE+MFEED(I)*XLCUT(NBODY1)
      XLOUT(I)=SOLUTE/LOUT(I)
  370 CONTINUE
      DO 410 9= ,N2O)Y
      K=NORD(I)
      IF(IFEED(K).GT.NBODY) GO TO 410
      J=NORD(I-1)
      IF(DESIGN.EQ.1.) GO TC 390
      IF(ISIM.EQ.1   .OR.   IAB1.EQ.0) GO TC 390
      IF(VDIFF.NE.0.) GO TO 380
      IF(K.NE.IFIRST) GO TO 390
      LOUT(K)=LINTER
      VDIFF=V(K)-(LOUT(J)+MFEED(K)-LOUT(K))
      V(K)=LOUT(J)+MFEED(K)-LOUT(K)
      GO TO 400
  380 IF(J.NE.IFIRST) GO TO 390
      V(K)=V(K)+VDIFF
      VDIFF=0.
  390 CONTINUE
      LOUT(K)=LOUT(J)+MFEED(K)-V(K)
  400 CONTINUE
      SOLUTE=SOLUTE+MFEED(K)*XLOUT(NBODY1)
      XLOUT(K)=SOLUTE/LOUT(K)
  410 CONTINUE
C     CALCULATE THE OUTGOING LIQUOR RATE FROM EACH LIQUOR FLASH TANK
C     AND FINISHER EFFECT.
      IF(IFINI.EQ.0)GGO TO 430
      IF(NFOR.NE.0) GO TO 430
      LFINO=LOUT(LBODY)-VFIN
      IF(NLFT.EQ.0) GO TO 490
      LLFTO(1)=LFINO-VLFT(1)
      IF(NLFT.EQ.1) GO TO 490
      DO 420 I=2,NLFT
      J=I-1
  420 LLFTO(I)=LLFTO(J)-VLFT(I)
      GO TO 490
  430 CONTINUE
      IF(NLFT.EQ.0) GO TO 490
      LLFTO(1)=LOUT(LBODY)-VLFT(1)
      IF(IFINI.EQ.1) GO TO 450
      IF(NLFT.EQ.1) GO TO 490
      DO 440 I=2,NLFT
      J=I 1
  440 LLFTO(I)=LLFTO(J)-VLFT(I)
      GO TO 490
      LOUT(K)=FF(I)-V(K)
  450 IF(NFOR.EQ.1) GO TO 470
      46 46  9=T85609
      J=I-1
  460 LLFTO(I)=LLFTO(J)-VLFT(I)
  470 CONTINUE
      L69NO=L3F30(NFOR)-VFIN
```

```
       IF(NLFT.EQ.NFOR) GO TC 490
       LLFTO(IFOR)=LFINO-VLFT(IFOR)
       IF(NLFT.EQ.IFOR) GO TC 490
       DO 480 I=IFOR1,NLFT
       J=I-1
  480 LLFTO(I)=LLFTO(J)-VLFT(I)
  490 CONTINUE
       XLOUT(NBODY2)=XLBODY
C      CALCULATE THE MASS FRACTION CF OUTGOING LIGUCR FROM EACH LIQUOR
C      FLASH TANK AND FINISHER EFFECT.
       IF(NLFT.EQ.0) GO TO 510
       DO 500 I=1,NLFT
  500 XLLFTO(I)=SOLUTE/LLFTC(I)
  510 CONT NUE
       IF(IFINI.EQ.0) GO TO 520
       XLF NO=SCLUTE/LFINO
  520 CONT.NUE
       IF(NLFT.EQ.0    .AND.    IFINI.EQ.0) GO TO 550
       IF(1FINI.EQ.C) GO TO 530
       IF(NLFT.EQ.NFOR) GO TC 540
  530 XLLFTO(NLFT)=XLOUT(NBCOY2)
       GO TO 550
  540 XLFINO=XLOUT(NBCOY2)
  550 CONTINUE
C      SUMBPR IS THE SUM OF BOILING POINT RISES IN ALL BODIES WHEN
C      IAB1=0, AND WHEN IAB1=1, THE BOILING POINT RISE IN FIRST BODY IS
C      EXCLUDED FROM THE SUM OF BOILING POINT RISES, SUMBPR.
       SUMBPR=0.
       IF(KALBPR.EQ.0) GO TO 560
C      CALCULATE THE BOILING POINT RISE IN EACH BODY.
       CALL BPRN(BPRISE,XLOUT,NBODY)
  560 CONT.NUE
       DO 580 I=1,NBODY
       IF(IAB1.EQ.0) GO TO 570
       IF(I.EQ.1) GO TO 580
  570 SUMBPR=SUMBPR+BPRISE(I)
  580 CONTINUE
C      CALCULATE THE COEFFICIENTS OF DTS AND SCLVE FOR THEM.
       IF(DESIGN.EQ.1.) GO TC 590
C      WHEN ISIM=0, DTS ARE KNOWN AND SO EXCLUCE THEIR CALCLLATIONS.
       F(ISIM.EQ.0) GO TO 730
  590 CONTINUE
       DO 600 I=1,IBODY1
       BX(I,1)=0.
       DO 600 J=1,IBODY
  600 AX(I,J)=0.
       IF(DESIGN.EQ.0.) GO TC 670
       DO 630 I=1,IBODY1
       II=
       J=I+1
       IF(IAB1.EQ.0) GO TO 610
       II=I +1
       J=J+1
       JJ=1,
       GO TO 620
  610 JJ=J
  620 AX(I,I)=(U(II)/Q(II))*10000.
  630 AX(I,JJ)=-(U(J)/Q(J))*10000.
       DO 660 K=1,NAAC
       IF(R(K).EQ.1.) GO TO 660
       IF(IAB1.EQ.0) GO TO 640
```

```
      LL=NAA(K)-1
      NA=NAA(K)
      GO TO 650
  640 LL=NAA(K)
      NA=NAA(K)+1
  650 AX(LL,NA)=AX(LL,NA)/R(K)
  660 CONTINUE
      GO TO 705
  670 DO 700 I=1,IBODY1
      II=
      J=I+1
      IF(IAB1.EQ.0) GO TO 680
      II=I +1
      J=J+1
      JJ=I
      GO TO 690
  680 JJ=J
  690 AX(I,I)=(U(II)*AA(II)/Q(II))*10.
  700 AX(I,JJ)=-(U(J)*AA(J)/Q(J))*10.
  705 CONTINUE
      DO 710 I=1,IBODY
  710 AX(IBODY,I)=1.
      BX(IBODY,1)=TS-TC(NBODY1)-SUMBPR
      CALL MATINV(AX,IBODY,BX,1,DET)
      DO 720 I=1,IBODY
      J=I+1
      IF(IAB1.EQ.0) J=J-1
  720 DT(J)=BX(I,1)
      IF(IAB1.EQ.0) GO TO 730
      DT(1)=DT(2)+BPRISE(2)-BPRISE(1)
  730 CONTINUE
C     CALCULATE THE TEMPERATURES OF OUTGOING LIQUOR STREAMS AND THE
C     SATURATED VAPOR CONDENSATE STREAMS OF ALL THE BODIES.
      TOUT(1)=TS-DT(1)
      IF(IAB1.EQ.0) GO TO 740
      TOUT(2)=TS-DT(2)
  740 CONTINUE
      DO 760 I=2,NBODY
      IF(IAB1.EQ.0) GO TO 750
      IF(I.EQ.2) GO TO 760
  750 TC(I)=TOUT(I-1)-BPRISE(I-1)
      TOUT(I)=TC(I)-DT(I)
  760 CONTINUE
C     CALCULATE THE SPECIFIC HEAT OF THE OUTGOING LIQUOR STREAMS OF
C     EACH BODY.
      CALL SPHTN(SPHT,XLOUT,TOUT,NBODY)
C     CALCULATE THE ENTHALPIES OF OUTGOING LIQUOR STREAMS OF ALL
C     THE BODIES.
      DO 790 I=1,NBODY
  790 HLOUT(I)=SPHT(I)*TOUT(I)
      HLOUT(NBODY1)=SPHTF*TF
C     CALCULATE THE ENTHALPIES OF OUTGOING VOPOR STREAMS OF ALL BODIES
      DO 800 I=1,IBODY
      K=I+1
  800 HV(I)=STEAMH(TC(K))+BPRISE(I)*1.0467
      HV(NBODY)=STEAMH(TC(NBODY1))+BPRISE(NBODY)*1.0467
C     CALCULATE THE ENTHALPIES OF SATURATED VAPOR CONDENSATE STREAMS
C     OF THE STEAM CHESTS OF ALL THE BODIES.
      DO 820 I=2,NBODY
      IF(IAB1.EQ.0) GO TO 810
      IF(I.EQ.2) GO TO 820
```

```
   810 HC(I)=CONDEN(TC(I))
   820 CONTINUE
       IF(NLFT.EQ.0) GO TO 870
       IF(KALBPR.EQ.0) GO TO 830
C      CALCULATE THE BOILING POINT RISE IN EACH LFT.
       CALL BPRN(BPRLFT,XLLFTO,NLFT)
   830 CONTINUE
C      CALCULATE THE OUTGOING LIQUOR TEMPERATURES FROM EACH LFT.
       DO 840 I=1,NLFT
       J=NLORD(I)
   840 TLFTO(I)=TC(J)+BPRLFT(I)
C      CALCULATE THE ENTHALPY OF THE VAPOR STREAMS FROM EACH LFT.
       DO 850 I=1,NLFT
       TCK=TLFTO(I)-BPRLFT(I)
       HVLFT(I)=STEAMH(TCK)+BPRLFT(I)*1.0467
   850 CONTINUE
C      CALCULATE THE SPECIFIC HEAT OF OUTGOING LIQUOR STREAM FROM EACH
C      LIQUOR FLASH TANK.
       CALL SPHTN(SPHLFT,XLLFTO,TLFTO,NLFT)
C      CALCULATE THE ENTHALPY OF OUTGOING LIQUOR STREAM FROM EACH LFT.
       DO 860 I=1,NLFT
   860 HLLFTO(I)=SPHLFT(I)*TLFTO(I)
   870 CONTINUE
C      CALCULATE THE FLOW RATE OF EACH BLEED VAPOR STREAM, VBLEED,
C      FROM THE HEAT REQUIREMENT, QBLEED FROM THE BLEED STREAM.
C      RBLEED(I)  IS THE RATIO OF BLEED VAPOR FLOW RATE, VBLEED(I), AND
C      TOTAL VAPOR FLOW RATE, V(I), FROM ITH BODY.
       IF(IBLEED.EQ.0) GO TO 910
       IF(IAB1.EQ.0) GO TO 880
C      WHEN IAB1=1, SINCE THE VAPORS OF FIRST TWO BODIES ARE COMBINED
C      AND WHATEVER BE THE HEAT TO BE BLED FROM EACH OF THESE BODIES,
C      THEY CAN BE SUMMED UP AND VAPORS CAN BE BLED FROM TOTAL VAPORS
C      OF THE TWO. FOR CALCULATION SIMPLIFICATIONS VBLEED(1) IS
C      ASSIGNED THE VALUE ZERO AND ALL THE BLEED VAPORS ARE ASSUMED TO
C      BE FRACTION OF VAPORS OF SECOND BODY. THIS ASSUMPTION MAY NOT BE
C      TRUE, BECAUSE AMOUNT CF VAPOR BLED MAY BE MORE THAN V(2), EVEN
C      THEN FURTHER CALCULATION METHOD WILL PROVIDE CORRECT RESULTS.
C      SO RBEED(1) WILL BE ZERO, AND RBLEED(2) CAN BE MORE THAN 1.0.
       VBLEED(1)=0.
       RBLEED(1)=0.
       VBLEED(2)=(QBLEED(1)+QBLEED(2))*3600./(HV(2)-HC(3))
       RBLEED(2)=VBLEED(2)/V(2)
   880 CONTINUE
       DO 900 I=1,NBODY
       IF(IAB1.EQ.0) GO TO 890
       IF(I.LE.2) GC TO 900
   890 VBLEED(I)=QBLEED(I)*3600./(HV(I)-HC(I+1))
       RBLEED(I)=VBLEED(I)/V(I)
   900 CONTINUE
   910 IF(IFINI.EQ.0) GO TO 980
       IF(KALBPR.EQ.0) GO TO 920
C      CALCULATE THE BOILING POINT RISE IN FINISHER EFFECT.
       CALL BPR1(BPRFIN,XLFINO)
   920 CONTINUE
C      CALCULATE THE TEMPERATURE, SPECIFIC HEAT AND ENTHALPY OF
C      OUTGOING LIQUOR STREAM FROM FINISHER EFFECT.
       TFINO=TC(NVORD)+BPRFIN
       CALL SPHT1(SPHFIN,XLFINO,TFINO)
       HLFINO=SPHFIN*TFINO
C      CALCULATE THE ENTHALPY OF VAPOR STREAM FROM FINISHER EFFECT.
       HVFIN=STEAMH(TC(NVORD))+BPRFIN*1.0467
```

```fortran
C        CALCULATE THE WORKING TEMPERATURE POTENTIAL IN THE FIN.
         DTFIN=TSFIN-TFINO
C        CALCULATE THE STEAM REQUIRED AND RATE OF HEAT TRANSFER IN THE
C        FINISHER EFFECT FROM THE HEAT BALANCES.
         IF(NFOR.EQ.0) GO TO 940
         SFIN=(VFIN*HVFIN+LFINC*HLFINO-LLFTO(NFOR)*HLLFTO(NFOR))/((HSFIN
     1   -HCFIN)*(1.-RLOSSF))
         QFIN=(VFIN*HVFIN+LFINO*HLFINO-LLFTC(NFOR)*HLLFTO(NFOR))/3600.
         GO TO 950
  940    SFIN=(VFIN*HVFIN+LFINO*HLFINO-LOUT(LBODY)*HLOUT(LBODY))/((HSFIN
     1   -HCFIN)*(1.-RLOSSF))
         QFIN=(VFIN*HVFIN+LFINO*HLFINO-LOUT(LBODY)*HLOUT(LBODY))/3600.
  950    CONTINUE
         IF(NFCFT.EQ.0) GO TO 980
C        CALCULATE THE ENTHALPIES OF VAPOR AND PRODUCT STREAMS OF EACH
C        FINISHER CONDENSATE FLASH TANK.
         DO 960 I=1,NFCFT
         K=NFCORD(I)
         J=K 1
         HCFFTO(I)=CONDEN(TOUT(J))
  960    HVFCFT(I)=HV(J)
C        CALCULATE THE FLOW RATES OF VAPOR AND PRODUCT STREAMS OF EACH
C        FINISHER EFFECT CONDENSATE FLASH TANK.
         VFCFT(1)=SFIN*(HCFIN-HCFFTO(1))/(HVFCFT(1)-HCFFTO(1))
         CFCFTO(1)=SFIN-VFCFT(1)
         IF(NFCFT.EQ.1) GO TO 980
         DO 970 I=2,NFCFT
         J=I 1
         VFCFT(I)=CFCFTO(J)*(HCFFTO(J)-HCFFTO(I))/(HVFCFT(I)-HCFFTO(I))
  970    CFCFTO(I)=CFCFTO(J)-VFCFT(I)
  980    CONTINUE
C        INITIALIZE THE TEMPERATURES OF INCOMING LIQUOR STREAM TO ANY
C        BODY EQUAL TO THE TEMPERATURE OF OUTGOING LIQUOR OF THE BODY
C        FROM WHERE IT IS FED TO THIS BODY. IF THE BODY IS LISTED IN THE
C        IFSORD ARRAY, THEN IT IS TO BE INITIALIZED TO INITIAL FEED
C        TEMPERATURE. LATER THESE TEMPERATURES WILL BE CORRECTED IF
C        LIQUOR IS COMING THROUGH INTEGRAL HEATERS.
         DO 990 I=1,KBODY
         J=NORD(I)
         JJ=NORD(I+1)
         TIN(JJ)=TOUT(J)
  990    CONTINUE
         DO 1000 I=1,IPFS
         K=IFSORD(I)
         TIN(K)=TF
 1000    CONTINUE
         K1=IFSORD(1)
         K2=0
         IF(IPFS.EQ.1) GO TO 1010
         K2=IFSORD(2)
 1010    CONTINUE
         IF(NIH.EQ.0) GO TO 1230
C        CALCULATE THE TEMPERATURE IN AND TEMPERATURE OUT OF EACH IH
C        BASED ON THE SPECIFIED APPROCH.
         IF(IPROCH.EQ.1) GO TO 1020
         IF(NIT.EQ.0) GO TO 1110
 1020    CONTINUE
         DO 1100 I=1,NBODY
         J=NBODY1-I
         IF(IIH(J).EQ.0) GO TO 1100
         IF(J.EQ.K2) GO TO 1045
```

```fortran
      DO 1030 II=1,KBODY
      IF(NORD(II).EQ.J) GO TO 1040
 1030 CONTINUE
      GO TO 1060
 1040 JJ=NORD(II+1)
      IF(J.LT.JJ) GO TO 1060
      TIHIN(J)=TOUT(J)
      GO TO 1080
 1045 CONTINUE
      IF(IIH(K1).EQ.0) GO TO 1050
      TIHIN(K2)=(LOUT(K1)*SPHT(K1)*TIHOUT(K1)+LOUT(K2)*SPHT(K2)*
     1TOUT(K2))/(0.5*LADD*(SPHT(K1)+SPHT(K2)))
      GO TO 1055
 1050 TIHIN(K2)=(LOUT(K1)*SPHT(K1)*TOUT(K1)+LOUT(K2)*SPHT(K2)*
     1TOUT(K2))/(0.5*LADD*(SPHT(K1)+SPHT(K2)))
 1055 CONTINUE
      IF(IPROCH.EQ.1) GO TO 1080
      TIHOUT(K2)=(UIH(K2)*AAIH(K2)*TC(K2)*3600.-0.5*UIH(K2)*AAIH(K2)*
     1 TIHIN(K2)*3600.+LADD*SPHT(K2)*TIHIN(K2))/(LADD*SPHT(K2)+0.5*
     2 UIH(K2)*AAIH(K2)*3600.)
      GO TO 1100
 1060 JJ=J+1
      IF(IIH(JJ).EQ.0) GO TO 1070
      TIHIN(J)=TIHOUT(JJ)
      GO TO 1080
 1070 TIHIN(J)=TOUT(JJ)
 1080 CONTINUE
      IF(IPROCH.EQ.1) GO TO 1090
      TIHOUT(J)=(UIH(J)*AAIH(J)*TC(J)*3600.-0.5*UIH(J)*AAIH(J)*
     1 TIHIN(J)*3600.+LOUT(J)*SPHT(J)*TIHIN(J))/(LOUT(J)*SPHT(J)+0.5*
     2 UIH(J)*AAIH(J)*3600.)
      GO TO 1100
 1090 TIHOUT(J)=TC(J)-(1.-RIH1)*(TC(J)-TIHIN(J))
 1100 CONTINUE
      GO TO 1140
C     WHEN IPROCH=0, FOR CALCULATING TEMPERATURE IN AND TEMPERATURE
C     OUT OF EACH INTEGRAL HEATER, BOTH THE VALUES OF HEAT TRANSFER
C     COEFFICIENT AND HEATING SURFACE AREA CF THE HEATER ARE REQUIRED.
C     SINCE IN FIRST ITERATION, BOTH ARE NOT KNOWN, THE TEMPERATURE IN
C     IS ASSUMED TO BE EQUAL TO OUTGOING LIQUCR TEMPERATURE OF THE
C     BODY FROM WHERE IT IS COMING TO IH ANC TEMPERATURE OUT FROM THE
C     IH IS ASSUMED TO BE EQUAL TO OUTGOING LIQUOR TEMPERATURE OF THE
C     BODY TO WHICH LIQUOR IS FED THROUGH IH.
 1110 DO 1120 I=1,NBODY
      IF(IIH(I).EQ.0) GO TO 1120
      TIHIN(I)=TOUT(I)
 1120 CONTINUE
      DO 1130 I=1,KBODY
      J=NORD(I)
      JJ=NORD(I+1)
      IF(IIH(J).EQ.0) GO TO 1130
      TIHOUT(J)=TOUT(JJ)
 1130 CONTINUE
C     CORRECT THE INCOMING LIQUOR TEMPERATURE TO EACH BODY ACCOUNTING
C     ITS PASSAGE THROUGH INTEGRAL HEATER.
 1140 DO 1190 I=2,NBODY
      J=NORD(I)
      JJ=NORD(I-1)
      II=J+1
      IF(J.EQ.K1   .OR.   J.EQ.K2) GO TO 1190
      IF(IPROCH.EQ.1) GO TO 1150
```

```
      IF(NIT.EQ.0) GO TO 1160
 1150 IF(JJ.LT.J) GO TO 119C
      IF(JJ.NE.II) GO TO 1170
 1160 IF(IIH(JJ).EQ.0) GO TC 1190
      TIN(J)=TIHOUT(JJ)
      GO TO 1190
 1170 IF(IIH(II).NE.0) GO TC 1180
      IF(II.EQ.JJ) GO TO 1190
      II=I +1
      GO TO 1170
 1180 TIN(J)=TIHOUT(II)
 1190 CONTINUE
C     CALCULATE THE DIFFERENCE BETWEEN TEMPERATURES OF OUTGOING AND
C     INCOMING LIQUOR TO THE INTEGRAL HEATER.
      DO 1200 I=1,NBODY
      IF(IIH(I).EQ.0) GO TO 1200
      DTIH(I)=TIHOUT(I)-TIHIN(I)
 1200 CONTINUE
C     CALCULATE THE AMOUNT CF HEAT TRANSFER IN EACH IH.
      DO 1220 I=1,NBODY
      IF(IIH(I).EQ.0) GO TO 1220
      IF(I.EQ.K2) GO TO 1210
      QIH(I)=(LOUT(I)*SPHT(I)*DTIH(I))/3600.
      GO TO 1220
 1210 QIH(I)=(LADD*SPHT(I)*DTIH(I))/3600.
 1220 CONT NUE
      GO TO 1260
C     CALCULATE THE TOTAL HEAT OF THE LIQUORS OUT FROM THE BODIES
C     LISTED IN IFSORD ARRAY, WHEN IPFS=2 AND THERE ARE NO IH IN THESE
C     BODIES.
 1230 HSUM=0.
      DO 1250 I=1,NBODY
      L=IFEED(I)
      IF(L.NE.NBODY3) GO TO 1250
      DO 1240 J=1,IPFS
      K=IFSORD(J)
 1240 HSUM=HSUM+LOUT(K)*SPHT(K)*TOUT(K)
C     CALCULATE THE ENTHALPY AND THE TEMPERATURE OF THIS OUTGOING
C     L QUORS MIXTURE.
      HLIN(I)=HSUM/LADD
      TIN(I)=HLIN(I)/(0.5*(SPHT(K1)+SPHT(K2)))
 1250 CONTINUE
C     CALCULATE THE ENTHALPY OF INCOMING LIQUCR STREAMS TO ALL BODIES.
 1260 DO 1310 I=1,NBODY
      IF(I.EQ.K1   .OR    I.EQ.K2) GO TO 13C0
      L=IFEED(I)
      IF(NIH.NE.0) GO TO 1270
      IF(L.EQ.NBODY3) GO TO 1310
 1270 DO 1280 J=1,NBODY
      IF(NORD(J).EQ.I) GO TC 1290
 1280 CONTINUE
 1290 JJ=NORD(J-1)
      HLIN(I)=SPHT(JJ)*TIN(I)
      GO TO 1310
 1300 HLIN(I)=SPHTF*TF
 1310 CONTINUE
C     ESTABLISH THE HEAT BALANCE EQUATIONS ANC SOLVE THEM FOR THE
C     VAPOR LEAVING EACH BOCY, EACH LIQUOR FLASH TANK AND FINISHER
C     EFFECT.
      NDMAT=IBODY+NLFT
      IF(IFINI.EQ.0) GO TO 1320
```

```
      NDMAT=NDMAT+1
1320  CONTINUE
      IDMAT=NDMAT
      IF(IAB1.EQ.0) GO TO 1330
      IDMAT=NDMAT+1
      VADD=V(1)-V(2)
1330  CONTINUE
      DO 1340 I=1,NDMAT
      DO 1340 J=1,NDMAT
1340  A(I,J)=0.
      DO 1490 I=1,IBODY1
      II='
      J=I+1
      IF(IAB1.EQ.0) GO TO 1350
      II=I +1
      J=J+1
      JJ=I
      IF(I.EQ.1) GO TO 1380
      GO TO 1360
1350  JJ=J
1360  A(I,I)=HV(II)-HC(J)
      A(I,JJ)=-HV(J)
      IF(IBLEED.EQ.0) GO TO 1370
      A(I,I)=A(I,I)*(1.-RBLEED(II))
1370  CONTINUE
      GO TO 1400
1380  A(I,I)=HV(I)+HV(II)-2.*HC(J)
      A(I,JJ)=-HV(J)
      IF(IBLEED.EQ.0) GO TO 1390
      A(I,I)=A(I,I)-RBLEED(II)*(HV(II)-HC(J))
1390  CONTINUE
1400  L=IFEED(J)
      IF(IAB1.EQ.0) GO TO 1410
      IF(I.EQ.1) GO TO 1420
1410  IF(L.GT.NBODY) GO TO 1430
      B(I,1)=LOUT(J)*HLOUT(J)-LOUT(L)*HLIN(J)-MFEED(J)*HMFEED
      GO TO 1460
1420  B(I,1)=LOUT(J)*HLOUT(J)-LOUT(L)*HLIN(J)-MFEED(J)*HMFEED-VADD*
     1 (HV(I)-HC(J))
      GO TO 1460
1430  IF(L.EQ.NBODY3) GO TO 1450
      IF(J.EQ.K2) GO TO 1440
      B(I,1)=LOUT(K1)*HLOUT(K1)-FF(1)*HLIN(K1)
      GO TO 1460
1440  IF(IPFS.EQ.1) GO TO 1460
      B(I,1)=LOUT(K2)*HLOUT(K2)-FF(2)*HLIN(K2)
      GO TO 1460
1450  B(I,1)=LOUT(J)*HLOUT(J)-LADD*HLIN(J)-MFEED(J)*HMFEED
1460  CONTINUE
      IF(IAB1.EQ.0) GO TO 1470
      IF(I.EQ.1) GO TO 1480
1470  A(IBODY,I)=1.
      GO TO 1490
1480  A(IBODY,I)=2.
1490  CONTINUE
      IF(NIH.EQ.0) GO TO 1510
      DO 1500 I=1,IBODY1
      J=I+2
      IF(IAB1.EQ.0) J=J-1
      IF(IIH(J).EQ.0) GO TO 1500
      B(I,1)=B(I,1)+QIH(J)*3600.
```

```
1500 CONTINUE
1510 A(IBODY,IBODY)=1.
     B(IBODY,1)=LOUT(NBODY1)-LOUT(NBODY2)
     IF(IAB1.EQ.0) GO TO 1520
     B(IBODY,1)=B(IBODY,1)-VADD
1520 CONTINUE
     IF(ICFT1.EQ.0) GO TO 1540
     DO 1530 I=1,NCFT
     J=NCORD(I)
     K=J-2
     IF(IAB1.EQ.0) K=K+1
1530 B(K,1)=B(K,1)-VCFT(I)*(HVCFT(I)-HC(J))
1540 CONTINUE
     KTM1=IBODY+1
     KTM2=IBODY+2
     IF(IFINI.EQ.0) GO TO 1560
     IF(NFCFT.EQ.0) GO TO 1560
     DO 1550 I=1,NFCFT
     J=NFCORD(I)
     K=J-2
     IF(IAB1.EQ.0) K=K+1
1550 B(K,1)=B(K,1)-VFCFT(I)*(HVFCFT(I)-HC(J))
1560 CONTINUE
     IF(IFINI.EQ.0) GO TO 1620
     IF(NFOR.NE.0) GO TO 1620
     J=NVORD-2
     IF(IAB1.EQ.0) J=J+1
     K=IBODY+1
     A(J,K)=HVFIN-HC(NVORD)
     A(K,K)=HVFIN
     A(IBODY,K)=1.
     B(K,1)=LOUT(LBODY)*HLOUT(LBODY)-LFINO*HLFINO+SFIN*(HSFIN-HCFIN)*
    1(1.-RLOSSF)
     V(NBODY1)=VFIN
1570 CONTINUE
     IF(NLFT.EQ.0) GO TO 1750
     DO 1580 I=1,NLFT
     KK=NLORD(I)
     J=KK 2
     IF(IAB1.EQ.0) J=J+1
     K=KTM1+
     A(J,K)=HVLFT(I)-HC(KK)
     A(K,K)=HVLFT(I)
1580 A(IBODY,K)=1.
     B(KTM2,1)=LFINO*HLFINO-LLFTO(1)*HLLFTO(1)
     IF(NLFT.EQ.1) GO TO 1600
     KK=NLFT-1
     DO 1590 I=1,KK
     J=I+1
     K=KTM2+I
1590 B(K,1)=LLFTO(I)*HLLFTO(I)-LLFTO(J)*HLLFTO(J)
1600 CONTINUE
     DO 1610 I=1,NLFT
     J=NBODY1+I
1610 V(J)=VLFT(I)
     GO TO 1750
1620 CONTINUE
     IF(NLFT.EQ.0) GO TO 1750
     IF(IFINI.EQ.1) GO TO 1680
     N1=NLFT
1630 DO 1640 I=1,N1
```

```
      KK=NLORD(I)
      J=KK 2
      IF(IAB1.EQ.0) J=J+1
      K=IBODY+I
      A(J,K)=HVLFT(I)-HC(KK)
      A(K,K)=HVLFT(I)
1640  A(IBODY,K)=1.
      B(KTM1,1)=LOUT(LBODY)*HLOUT(LBODY)-LLFTC(1)*HLLFTO(1)
      IF(N1.EQ.1) GO TO 1660
      KK=N1-1
      DO 1650 I=1,KK
      J=I+1
      K=KTM1+J
1650  B(K,1)=LLFTO(I)*HLLFTC(I)-LLFTO(J)*HLLFTO(J)
1660  DO 1670 I=1,N1
      J=NBODY+I
1670  V(J)=VLFT(I)
      IF(IFINI.EQ.1) GO TO 1690
      GO TO 1750
1680  CONTINUE
      N1=NFOR
      GO TO 1630
1690  CONTINUE
      J=NVORD-2
      IF(IAB1.EQ.0) J=J+1
      K=KTM1+NFOR
      A(J,K)=HVFIN-HC(NVORD)
      A(K,K)=HVFIN
      A(IBODY,K)=1.
      B(K,1)=LLFTO(NFOR)*HLLFTO(NFOR)-LFINO*HLFINO+SFIN*(HSFIN-HCFIN)*   MI
     1(1.-RLOSSF)
      KK=NBODY1+NFOR
      V(KK)=VFIN
1700  CONTINUE
      IF(NLFT.EQ.NFOR) GO TO 1750
      DO 1710 I=IFOR,NLFT
      KK=NLORD(I)
      J=KK-2
      IF(IAB1.EQ.0) J=J+1
      K=KTM1+I
      A(J,K)=HVLFT(I)-HC(KK)
      A(K,K)=HVLFT(I)
1710  A(IBODY,K)=1.
      K=KTM1+IFOR
      B(K,1)=LFINO*HLFINO-LLFTO(IFOR)*HLLFTC(IFOR)
      IF(NLFT.EQ.IFOR) GO TO 1730
      DO 1720 I=IFOR,NLFT
      J=I+1
      K=KTM2+I
1720  B(K,1)=LLFTO(I)*HLLFTO(I)-LLFTO(J)*HLLFTO(J)
1730  DO 1740 I=IFOR,NLFT
      J=NBODY1+I
1740  V(J)=VLFT(I)
1750  CONTINUE
      IF(FCHEAT.EQ.0.) GO TO 1920
      IF(IAB1.EQ.0) GO TO 1780
      DO 1760 I=2,IBODY1
      K=I+1
      KK=K+1
      A(I,1)=2.*(HC(K)-HC(KK))
      IF(IBLEED.EQ.0) GO TO 1760
```

```
      IF(ICBLED.EQ.0) GO TO 1760
      A(I,1)=A(I,1)-RBLEED(2)*(HC(K)-HC(KK))
1760  CONTINUE
      DO 1770 I=3,IBODY1
      K=I+1
      KK=K+1
      KN=I-1
      DO 1770 J=2,KN
      A(I,J)=(HC(K)-HC(KK))
      IF(IBLEED.EQ.0) GO TO 1770
      IF(ICBLED.EQ.0) GO TO 1770
      A(I,J)=A(I,J)*(1.-RBLEED(J+1))
1770  CONTINUE
      GO TO 1800
1780  DO 1790 I=2,IBODY1
      K=I+1
      KN=I-1
      DO 1790 J=1,KN
      A(I,J)=HC(I)-HC(K)
      IF(IBLEED.EQ.0) GO TO 1790
      IF(ICBLED.EQ.0) GO TO 1790
      A(I,J)=A(I,J)*(1.-RBLEED(J))
1790  CONTINUE
1800  IF(NLFT.EQ.0) GO TO 1830
      DO 1820 I=1,NLFT
      K=NLORD(I)
      IF(IAB1.EQ.1) K=K-1
      DO 1810 J=K,IBODY1
      KK=J+1
      IF(IAB1.EQ.0) KK=KK-1
      KN=KK+1
1810  B(J,1)=B(J,1)-VLFT(I)*(HC(KK)-HC(KN))
1820  CONTINUE
1830  IF(IFINI.EQ.0) GO TO 1870
      K=NVORD
      IF(IAB1.EQ.1) K=K-1
      DO 1840 J=K,IBODY1
      KK=J+1
      IF(IAB1.EQ.0) KK=KK-1
      KN=KK+1
      B(J,1)=B(J,1)-VFIN*(HC(KK)-HC(KN))
1840  CONTINUE
      IF(NFCFT.EQ.0) GO TO 1870
      DO 1860 I=1,NFCFT
      K=NFCORD(I)
      IF(IAB1.EQ.1) K=K-1
      DO 1850 J=K,IBODY1
      KK=J+1
      IF(IAB1.EQ.0) KK=KK-1
      KN=KK+1
1850  B(J,1)=B(J,1)-VFCFT(I)*(HC(KK)-HC(KN))
1860  CONTINUE
1870  IF(ICFT1.EQ.0) GO TO 1900
      DO 1890 I=1,NCFT
      K=NCORD(I)
      IF(IAB1.EQ.1) K=K-1
      DO 1880 J=K,IBODY1
      KK=J+1
      IF(IAB1.EQ.0) KK=KK-1
      KN=KK+1
1880  B(J,1)=B(J,1)-VCFT(I)*(HC(KK)-HC(KN))
```

```
 1890 CONTINUE
 1900 IF(IAB1.EQ.0) GO TO 1920
      DO 1910 I=2,IBODY1
      K=I+1
      KK=K+1
 1910 B(I,1)=B(I,1)-VADD*(HC(K)-HC(KK))
 1920 CONTINUE
      CALL MATINV(A,NDMAT,B,1,DET)
      NIT=NIT+1
      DO 1930 I=1,NDMAT
      II=I+1
      IF(IAB1.EQ.0) II=II-1
C     CHECK THE CONVERGENCE OF THE CALCULATION PROCESS.
      IF(ABS(B(I,1)-V(II)).GT.1.   .AND.   NIT.LT.MAXNIT) GO TO 1940
 1930 CONTINUE
C     IF STATEMENT 1930, IT CONVERGED.
      ICONV=1
C     IF STATEMENT 1940, IT HAS NOT CONVERGED.
 1940 CONTINUE
      DO 1960 I=1,IDMAT
      II=I
      IF(IAB1.EQ.0) GO TO 1950
      IF(I.EQ.1) GO TO 1960
      II=II-1
 1950 V(I)=B(II,1)
 1960 CONTINUE
      IF(IAB1.EQ.0) GO TO 1970
      V(1)=V(2)+VADD
 1970 CONTINUE
      IF(IFINI.EQ.0) GO TO 1990
      IF(NFOR.NE.0) GO TO 1990
      K=NBODY+1
      VFIN=V(K)
      IF(NLFT.EQ.0) GO TO 2050
      DO 1980 I=1,NLFT
      J=NBODY1+I
 1980 VLFT(I)=V(J)
      GO TO 2050
 1990 CONTINUE
      IF(NLFT.EQ.0) GO TO 2050
      IF(IFINI.EQ.1) GO TO 2020
      N1=NLFT
 2000 DO 2010 I=1,N1
      K=NBODY+I
 2010 VLFT(I)=V(K)
      IF(IFINI.EQ.1) GO TO 2030
      GO TO 2050
 2020 CONTINUE
      N1=NFOR
      GO TO 2000
 2030 CONTINUE
      K=NBODY+IFOR
      VFIN=V(K)
      IF(NLFT.EQ.NFOR) GO TO 2050
      DO 2040 I=IFOR,NLFT
      K=NBODY1+I
 2040 VLFT(I)=V(K)
 2050 CONTINUE
C     CALCULATE THE RATE OF HEAT TRANSFER IN EACH BODY.
      DO 2070 I=1,2
      L=IFEED(I)
```

```
      IF(IAB1.EQ.1) GO TO 2C60
      IF(I.EQ.2) GC TO 2070
 2060 Q(I)=(V(I)*HV(I)+LOUT(I)*HLOUT(I)-LOUT(L)*HLIN(I)-MFEED(I)*
     1 HMFEED)/3600.
      IF(IIH(I).EQ.0) GO TO 2070
C     ACCOUNT THE HEAT REQUIREMENT BY IH IN THIS BODY.
      Q(I)=Q(I)+QIH(I)
 2070 CONTINUE
      IF( AB1.EQ.0) GO TO 2C80
      Q(3)=(V(1)*(HV(1)-HC(3))+V(2)*(HV(2)-HC(3)))/3600.
      IF(IBLEED.EQ.0) GO TO 2090
C     ACCOUNT THE HEAT CARRIED AWAY BY THE BLEED STREAMS.
      Q(3)=Q(3)-QBLEED(1)-QBLEED(2)
      GO TO 2090
 2080 Q(2)=(V(1)*(HV(1)-HC(2)))/3600.
      IF(IBLEED.EQ.0) GO TO 2090
      Q(2)=Q(2)-QBLEED(1)
 2090 CONTINUE
      DO 2130 I=3,NBODY
      IF(IAB1.EQ.0) GO TO 2100
      IF(I.EQ.3) GO TO 2130
 2100 J=I-1
      VFCON=0.
      IF(FCHEAT.EQ.0.) GO TC 2120
      K=I 2
      DO 2110 JJ=1,K
 2110 VFCON=VFCON+V(JJ)
 2120 CONTINUE
      Q(I)=(V(J)*(HV(J)-HC(I))+VFCON*(HC(J)-HC(I)))/3600.
      IF(IBLEED.EQ.0) GO TO 2130
      Q(I)=Q(I)-QBLEED(J)
 2130 CONTINUE
      IF(IAB1.EQ.0) GO TO 2180
      IF(DESIGN.EQ.1.) GO TC 2140
      IF(ISIM.EQ.0) GO TO 2150
 2140 CONTINUE
C     CALCULATE THE FRESH INPUT STEAM REQUIREMENTS OF BOTH THE BODIES
      AAV=Q(1)/(2.0*U(1)*DT(1))+Q(2)*RAB1/(2.C*U(2)*DT(2))
      SABONE(1)= AAV*U(1)*CT(1)*3600./((HS-HC(1))*(1.-RLOSS))
      SABONE(2)=(AAV/RAB1)*U(2)*DT(2)*3600./((HS-HC(2))*(1.-RLOSS))
      GO TO 2170
 2150 DO 2160 I=1,2
 2160 SABONE(I)=Q(I)*3600./((HS-HC(I))*(1.-RLCSS))
 2170 CONTINUE
      S=SABONE(1)+SABONE(2)
      GO TO 2190
C     CALCULATE THE FRESH INPUT STEAM REQUIREMENT OF THE FIRST BODY,
C     WHEN IAB1=0.
 2180 S=Q(1)*3600./((HS-HC(1))*(1.-RLOSS))
 2190 CONTINUE
      IF(NCFT.EQ.0) GO TO 2250
C     CALCULATE THE ENTHALPIES OF VAPOR AND CONDENSATE STREAMS FROM
C     EACH CFT.
      DO 2200 I=1,NCFT
      K NCORD(I)
      J=K-1
      HCCFTO(I)=CONDEN(TOUT(J))
 2200 HVCFT(I)=HV(J)
C     CALCULATE THE FLOW RATES OF VAPOR AND CONDENSATE STREAMS FROM
C     EACH CFT.
      VCFT(1)=S*(HC(1)-HCCFTO(1))/(HVCFT(1)-HCCFTO(1))
```

```
      CCFTO(1)=S-VCFT(1)
      IF(NCFT.EQ.1) GO TO 2220
      DO 2210 I=2,NCFT
      J=I 1
      VCFT(1)=CCFTO(J)*(HCCFTO(J)-HCCFTO(I))/(HVCFT(I)-HCCFTO(I))
 2210 CCFTO(I)=CCFTO(J)-VCFT(I)
 2220 ICFT1=1
C     ACCOUNT THE HEAT CONTRIBUTION BY VAPOR FROM EACH CFT.
      DO 2230 I=1,NCFT
      K=NCORD(I)
 2230 Q(K)=Q(K)+VCFT(I)*(HVCFT(I)-HC(K))/3600.
      IF(FCHEAT.EQ.0.) GO TO 2250
      DO 2240 I=1,NCFT
      K=NCORD(I)
      KK=K+1
      DO 2240 J=KK,NBODY
      L=J-1
      Q(J)=Q(J)+VCFT(I)*(HC(L)-HC(J))/3600.
 2240 CONTINUE
 2250 IF(NLFT.EQ.0) GO TO 2280
C     ACCOUNT THE HEAT CONTRIBUTION BY VAPOR FROM EACH LFT.
      DO 2260 I=1,NLFT
      K=NLORD(I)
 2260 Q(K)=Q(K)+VLFT(I)*(HVLFT(I)-HC(K))/3600.
      IF(FCHEAT.EQ.0.) GO TO 2280
      DO 2270 I=1,NLFT
      K=NLORD(I)
      KK=K+1
      DO 2270 J=KK,NBODY
      L=J-1
      Q(J)=Q(J)+VLFT(I)*(HC(L)-HC(J))/3600.
 2270 CONTINUE
 2280 IF(IFINI.EQ.0) GO TO 2330
C     ACCOUNT THE HEAT CONTRIBUTION BY VAPOR FROM FIN.
      Q(NVORD)=Q(NVORD)+VFIN*(HVFIN-HC(NVORD))/3600.
      IF(FCHEAT.EQ.0.) GO TO 2300
      KK=NVORD+1
      DO 2290 J=KK,NBODY
      L=J-1
 2290 Q(J)=Q(J)+VFIN*(HC(L)-HC(J))/3600.
 2300 CONTINUE
      IF(NFCFT.EQ.0) GO TO 2330
C     ACCOUNT THE HEAT CONTRIBUTION BY VAPOR FROM EACH FCFT.
      DO 2310 I=1,NFCFT
      K=NFCORD(I)
 2310 Q(K)=Q(K)+VFCFT(I)*(HVFCFT(I)-HC(K))/3600.
      IF(FCHEAT.EQ.0.) GO TO 2330
      DO 2320 I=1,NFCFT
      K=NFCORD(I)
      KK=K+1
      DO 2320 J=KK,NBODY
      L=J-1
 2320 Q(J)=Q(J)+VFCFT(I)*(HC(L)-HC(J))/3600.
 2330 CONTINUE
      IF(IAB1.EQ.0) GO TO 2390
      IF (ICONV) 2340,2340,2390
C     CORRECT THE VALUES OF VAPOR FLOW RATES FROM FIRST TWO BODIES
C     WITH THE HELP OF THEIR HEAT BALANCES, WHEN IAB1=1.
 2340 DO 2380 I=1,2
      J=IFEED(I)
      IF(J.EQ.NBODY3) GO TO 2350
```

```
        IF(J EQ.NBODY3) GO TC 2350
        IF(1 EQ.K1) GO TO 236C
        IF(I.EQ.K2) GO TO 237C
        V(1)=(LOUT(J)*HLIN(I)-LOUT(I)*HLOUT(I)+MFEED(I)*HMFEED
     1 +SABONE(I)*(HS-HC(I))*(1.-RLOSS))/HV(I)
        GO TU 2380
 2350 V(I)=  (LADD *HLIN(I)-LOUT(I)*HLOUT(I)+MFEED(I)*HMFEED
     1 +SABONE(1)*(HS-HC(I))*(1.-RLOSS))/HV(I)
        GO IC 2330
 2360 V(I)= (FF(1) *HLIN(I)-LOUT(I)*HLOUT(I)+MFEED(I)*HMFEED
     1 +SABONE(.)*(HS-HC(I))*(1.-RLOSS))/HV(I)
        GO TO 2330
 237C V(I)= (FF(2) *HLIN(I)-LOUT(I)*HLOUT(I)+MFEED(I)*HMFEED
     1 +SABONE(I)*(HS-HC(I))*(1.-RLOSS))/HV(I)
 2380 CONTINUE
 2390 IF(DESIGN.EQ.0.) GO TC 2420
C     CALCULATE THE HEATING SURFACE AREA OF EACH BODY.
        DO 2410 I=1,NBCDY
        AA(I)=Q(I)/(U(I)*DT(I))
        IF(IIH(I).EQ.0) GO TO 2410
C     CALCULATE THE HEATING SURFACE AREA OF EACH INTEGRAL HEATER
C     BASED ON THE SPECIFIED APPROCH.
        IF((PROCH.EQ.1) GO TO 2400
        AAIH(1)=AA(I)*RIH
        GO TO 2410
 2400 AAIH(I)=QIH(I)/(UIH(I)*(TC(I)-0.5*(TIHOLT(I)+TIHIN(I))))
 2410 CONTNUE
        IF(IFINI.EC.0) GO TO 2470
C     CALCULATE THE HEATING SURFACE AREA OF THE FIN.
        AAFIN=QFIN/(LFIN*DTFIN)
        GO TO 2470
 2420 CONTINUE
        DO 2430 I=1,NBODY
        IF(IIH(I).EQ.0) GO TC 2430
C     CALCULATE THE HEAT TRANSFER COEFFICIENT OF IH.
        UIH(I)=QIH(I)/(AAIH(I)*(TC(I)-0.5*(TIHOUT(I)+TIHIN(I))))
 2430 CONTNUE
        IF(IFINI.EQ.C) GO TO 2440
C     CALCULATE THE HEAT TRANSFER COEFFICIENT OF FIN.
        UFIN=QFIN/(AAFIN*DTFIN)
 2440 IF(ISIM.EQ.0) GO TO 2450
        IF (ICONV) 2470,2470,2450
 2450 DO 2460 I=1,NBODY
C     CALCULATE THE HEAT TRANSFER COEFFICIENT OF EACH BODY.
 2460 U(I)=Q(I)/(AA(I)*DT(I))
 2470 CONT NUE
        IF(ICONV) 300,300,248C
 2480 CONTINUE
C     CALCULATE THE STEAM ECONOMY OF THE PLANT.
        IF(IFINI.EQ.0) GO TO 2490
        ECONMY=TOTEVP/(S+SFIN)
        GO TU 2500
 2490 ECONMY=TOTEVP/S
 2500 CONTINUE
C     PRINT THE RESULTS.
        WRITE (6,2670) IPLANT
        WRITE (6,2680) NEFF,NBODY
        WRITL (6,269C) (NORD(I), I=1,NBODY)
        WRITE (6,2700) (IFEED(I), I=1,NBODY)
        WRITE (6,271C) DESIGN,FCHEAT
```

```
      WRITE (6,2730) RAB1
2510 CONTINUE
      IF(DESIGN.EQ.0.) GO TO 2530
      WRITE (6,2740) (1,R(I), I=1,NAAC)
      DO 2520 I=1,NAAC
      IF(R(I).EQ.1.) GO TO 2520
      WRITE (6,2750) I,NAA(I)
2520 CONTINUE
      GO TO 2540
2530 WRITE (6,2760) ISIM
2540 WRITE(6,2770) NLFT,NCFT,NIH,IFINI,IBLEED,KALBPR
      WRITE (6,2780) LOUT(NBODY1),XLOUT(NBODY1),XLOUT(NBODY2)
      WRITE (6,2790) IPFS,(IFSORD(I), I=1,IPFS)
      WRITE (6,2800) (I,FF(I), I=1,IPFS)
      WRITE (6,2810) (I,MFEED(I), I=1,NBODY)
      WRITE (6,2820)
      WRITE (6,2830) (I,U(I),AA(I),Q(I), I=1,NBODY)
      WRITE (6,2840)
      WRITE (6,2830) (I,V(I),LOUT(I),XLOUT(I), I=1,NBODY)
      WRITE (6,2850)
      WRITE (6,2830) (1,TC(I),TIN(I),TOUT(I), I=1,NBODY)
      WRITE (6,2860)
      WRITE (6,2830) (I,DT(I),BPRISE(I),HV(I), I=1,NBODY)
      WRITE (6,3020)
      WRITE (6,2870)
      WRITE (6,2830) (I,HLIN(I),HLOUT(I),HC(I), I=1,NBODY)
      IF(IBLEED.EQ.0) GO TO 2550
      WRITE (6,2880) ICBLED
      WRITE (6,2890)
      WRITE (6,2900) (I,QBLEED(I),VBLEED(I), I=1,NBODY)
2550 CONTINUE
      IF(NIH.EQ.0) GO TO 2610
      IF(IPROCH.EQ.1) GO TO 2560
      WRITE (6,2910) IPROCH,RIH
      GO TO 2570
2560 WRITE (6,2920) IPROCH,RIH1
2570 CONTINUE
      WRITE (6,2930) (IIH(I), I=1,NBODY)
      WRITE (6,2940)
      NIH1=0
      DO 2580 I=1,NBODY
      IF(IIH(I).EQ.0) GO TO 2580
      NIH1=NIH1+1
      WRITE (6,2950) NIH1,I,UIH(I),AAIH(I)
2580 CONTINUE
      WRITE (6,2960)
      NIH1=0
      DO 2590 I=1,NBODY
      IF(IIH(I).EQ.0) GO TO 2590
      NIH1=NIH1+1
      WRITE (6,2950) NIH1,I,TIHIN(I),TIHOUT(I)
2590 CONTINUE
      WRITE (6,2970)
      NIH1=0
      DO 2600 I=1,NBODY
      IF(IIH(I).EQ.0) GO TO 2600
      NIH1=NIH1+1
      WRITE (6,2950) NIH1,I,DTIH(I),QIH(I)
2600 CONTINUE
2610 IF(NLFT.EQ.0) GO TO 2620
      WRITE (6,2980) (NLORD(I), I=1,NLFT)
```

```
      WRITE (6,2990)
      WRITE (6,3030) (I,LLFTO(I),VLFT(I), I=1,NLFT)
      WRITE (6,3040)
      WRITE (6,3030) (I,XLLFTO(I),BPRLFT(I), I=1,NLFT)
 2620 CONTINUE
      IF(NCFT.EQ.0) GO TO 2630
      WRITE (6,3050) (NCORD(I), I=1,NCFT)
      WRITE (6,2990)
      WRITE (6,3060) (I,CCFTO(I),VCFT(I), I=1,NCFT)
 2630 CONTINUE
      IF(IFINI.EQ.0) GO TO 2640
      WRITE (6,3020)
      WRITE (6,3070) NVORD,NFOR,NFCFT,RLOSSF
      WRITE (6,3080) TSFIN,TFINO,CTFIN,BPRFIN
      WRITE (6,3090) HLFINO,HVFIN,LFINO,VFIN
      WRITE (6,3100) XLFINO,QFIN,UFIN,AAFIN
      IF(NFCFT.EQ.0) GO TO 2640
      WRITE (6,3110) (NFCORD(I), I=1,NFCFT)
      WRITE (6,3120)
      WRITE (6,3060) (I,CFCFTO(I),VFCFT(I), I=1,NFCFT)
 2640 CONTINUE
      WRITE (6,3130) LOUT(NBODY2),TOTEVP
      IF(IAB1.EQ.0) GO TO 2650
      WRITE (6,3140) (I,SABCNE(I), I=1,2)
 2650 CONTINUE
      WRITE (6,3150) S
      IF(IFINI.EQ.0) GO TO 2660
      WRITE (6,3160) SFIN
 2660 CONTINUE
      WRITE (6,3170) ECONMY,NIT
C
 2670 FORMAT(1H1,//,54X,*PLANT NO.*,I3,//)
 2680 FORMAT(25X,*NUMBER OF EFFECTS*,I3,20X,*NUMBER OF BODIES*,I3)
 2690 FORMAT(25X,*FLOW ORDER *,20I3)
 2700 FORMAT(25X,*IFEED ARRAY*,20I3)
 2710 FORMAT(25X,*DESIGN =*,F6.2,26X,*FCHEAT =*,F6.2)
 2720 FORMAT(25X,*STEAM TEMP. =*,F8.2,19X,*FEED TEMP. =*,F8.2,/,25X,
     1 *CONDENSATE TEMP. =*,F8.2,14X,*RADIATION LOSS FRACTION=*,F6.3)
 2730 FORMAT(25X,*AREA RATIO OF BODY(1) TO BODY(2) =*,F6.3)
 2740 FORMAT(25X,*AREA RATIO*,I3,* =*,F8.4)
 2750 FORMAT(25X,*NAA*,7X,I3,* =*,I3)
 2760 FORMAT(25X,*ISIM =*,I3)
 2770 FORMAT(25X,*LIQUOR FLASH TANK*,I3,20X,*CONDENSATE FLASH TANK*,
     1 I3,/, 25X,*INTEGRAL HEATER*,I3,22X,*FINISHER EFFECT*,I3,/,25X,
     2 *IBLEED*,I3,31X,*KALBPR*,I3)
 2780 FORMAT(25X,*TOTAL FEED FLOW RATE =*,F15.2,/,25X,
     1 *MASS FRACTION FEED =*,F6.3,14X,*MASS FRACTION PRODUCT =*,F6.3)
 2790 FORMAT(25X,*NUMBER OF FEED STREAMS*,I3,15X,*IFSORD ARRAY*,2I3)
 2800 FORMAT(25X,*FEED STREAM*,I3,22X,F15.2)
 2810 FORMAT(25X,*MULTIPLE FEED STREAM TO BODY*,I3,5X,F15.2)
 2820 FORMAT(/,43X,*H T COEFF*,13X,*AREA*,14X,*H T RATE*)
 2830 FORMAT(25X,*BODY*,I3,3X,3E20.8)
 2840 FORMAT(43X,*VAPOR FLOW*,11X,*PRODUCT*,11X,*MASS FRACTION*)
 2850 FORMAT(44X,*TEMP C*,13X,*TEMP TIN*,12X,*TEMP TOUT*)
 2860 FORMAT(43X,*TEMP DIFF*,12X,*BPRISE*,12X,*ENTHALPY V*)
 2870 FORMAT(42X,*ENTHALPY LIN*,8X,*ENTHALPY LOUT*,8X,*ENTHALPY C*)
 2880 FORMAT(/,25X,*ICBLED =*,I3)
 2890 FORMAT(64X,*QBLEED*,14X,*VBLEED*)
 2900 FORMAT(25X,*BLEED STREAM FROM BODY*I3,5X,2E20.8)
 2910 FORMAT(/,25X,*IPROCH =*,I3,25X*SPECIFIED AREA RATIO =*,F6.3)
 2920 FORMAT(/,25X,*IPROCH =*,I3,25X,*SPECIFIED TEMP. DIFF. RATIO=*,
```

```
      1 F6.3)
 2930 FORMAT(25X,*IIH ARRAY =*,20I3)
 2940 FORMAT(63X,*H T COEFF*,13X,*AREA*)
 2950 FORMAT(25X,*INTEGRAL HEATER*,I2,2X,*IN BODY*,I3,1X,2E20.8)
 2960 FORMAT(63X,*TEMP TIHIN*,10X,*TEMP TIHOUT*)
 2970 FORMAT(63X,*TEMP DIFF*,11X,*H T RATE*)
 2980 FORMAT(/,25X,*NLORD ARRAY =*,10I3)
 2990 FORMAT(64X,*PRODUCT*,12X,*VAPOR FLOW*)
 3000 FORMAT(40I2)
 3010 FORMAT(8F10.0)
 3020 FORMAT(1H1,//)
 3030 FORMAT(25X,*LIQUOR FLASH TANK*,I3,10X,2E20.8)
 3040 FORMAT(62X,*MASS FRACTION*,9X,*BPRLFT*)
 3050 FORMAT(/,25X,*NCORD ARRAY =*,10I3)
 3060 FORMAT(25X,*CONDENSATE FLASH TANK*,I3,6X,2E20.8)
 3070 FORMAT(/,25X,*NVORD =*,I3,/,25X,
      1 *NUMBER OF LIQUOR FLASH TANK BEFORE FINISHER*I3,/,25X,
      2 *FINISHER CONDENSATE FLASH TANK*I3,/,25X,
      3 *RADIATION LOSS FRACTION IN FINISHER =*,F8.4)
 3080 FORMAT(25X,*STEAM TEMP. =*,4X,F8.3,14X,*LIQUOR TEMP. =*,2X,F8.3,
      1 /,25X,*TEMP. DIFF. =*,4X,F8.3,14X,*BPRFIN =*,8X,F8.3)
 3090 FORMAT(25X,*ENTHALPY HLFINO =*,E15.8,7X,*ENTHALPY VFINO =*,
      1 E15.8,/,25X,*PRODUCT =*,8X,E15.8,7X,*VAPOR FLOW =*,4X,E15.8)
 3100 FORMAT(25X,*MASS FRACTION =*,2X,E15.8,7X,*H T RATE =*,6X,E15.8,
      1 /,25X,*H T COEFF =*,6X,E15.8,7X,*AREA =*,10X,E15.8)
 3110 FORMAT(/,25X,*NFCORD ARRAY =*,10I3)
 3120 FORMAT(25X,*FINISHER*,31X,*PRODUCT*,12X,*VAPOR FLOW*)
 3130 FORMAT(//,25X,*FINAL PRODUCT FLOW RATE =*,10X,F10.2,1X,*KGS/HR*,
      1 /,25X,*TOTAL EVAPORATION IN THE PLANT =*,3X,F10.2,1X,*KGS/HR*)
 3140 FORMAT(25X,*STEAM REQUIRED IN BODY(*,I1,*) =*,8X,F10.2,1X,
      1 *KGS/HR*)
 3150 FORMAT(25X,*TOTAL STEAM REQUIRED IN BODIES =*,F13.2,1X,*KGS/HR*)
 3160 FORMAT(25X,*STEAM REQUIRED IN FINISHER EFFECT =*,F10.2,1X,
      1 *KGS/HR*)
 3170 FORMAT(25X,*STEAM ECONOMY =*,11X,F7.4,1X,*KGS VAPOR/KG STEAM*,/,
      1 25X,*NUMBER OF ITERATIONS =*,I3)
C
 3180 CONTINUE
      IF (ICONV) 300,300,3190
 3190 IF(IPLANT.EQ.NPLANT) GO TO 3200
      IPLANT=IPLANT+1
      GO TO 20
 3200 WRITE(6,3020)
      STOP
      END
```

APPENDIX   D

PROCESS DESIGN OF EVAPORATION PLANTS
BY MEEDS — PROGRAM OUTPUTS

PLANT NO. 1

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  6
FLOW ORDER    5  6  4  3  2  1
IFEED ARRAY   2  3  4  6  7  5
DESIGN =  1.00                          FCHEAT =  1.00
STEAM TEMP. =  135.56                   FEED TEMP. =    71.11
CONDENSATE TEMP. =    51.67             RADIATION LOSS FRACTION= 0.030
AREA RATIO  1 =  1.0000
LIQUOR FLASH TANK  0                    CONDENSATE FLASH TANK  0
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  1               IFSORD ARRAY  5
FEED STREAM  1                             151063.00
MULTIPLE FEED STREAM TO BODY  1                0.00
MULTIPLE FEED STREAM TO BODY  2                0.00
MULTIPLE FEED STREAM TO BODY  3                0.00
MULTIPLE FEED STREAM TO BODY  4                0.00
MULTIPLE FEED STREAM TO BODY  5                0.00
MULTIPLE FEED STREAM TO BODY  6                0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.11805000E 01	0.77077030E 03	0.15477879E 05
BODY	2	0.22259300E 01	0.77076755E 03	0.14103379E 05
BODY	3	0.21918600E 01	0.77076565E 03	0.13135769E 05
BODY	4	0.17943700E 01	0.77076441E 03	0.12196799E 05
BODY	5	0.13628200E 01	0.77075727E 03	0.94990192E 04
BODY	6	0.10789000E 01	0.77075698E 03	0.11006383E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.22716624E 05	0.40467455E 05	0.52000000E 00
BODY	2	0.20344685E 05	0.63183945E 05	0.33304466E 00
BODY	3	0.18314225E 05	0.83528548E 05	0.25192675E 00
BODY	4	0.13532960E 05	0.10184273E 06	0.20662325E 00
BODY	5	0.15534334E 05	0.13552849E 06	0.15526681E 00
BODY	6	0.20152718E 05	0.11537578E 06	0.18238728E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.10275278E 03	0.11854936E 03
BODY	2	0.11097309E 03	0.90683811E 02	0.10275278E 03
BODY	3	0.98459169E 02	0.78975739E 02	0.90683811E 02
BODY	4	0.87794594E 02	0.53361937E 02	0.78975739E 02
BODY	5	0.76867104E 02	0.71110000E 02	0.67823893E 02
BODY	6	0.66597608E 02	0.67823893E 02	0.53361937E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.17010634E 02	0.75762718E 01	0.27002429E 04
BODY	2	0.82203113E 01	0.42936124E 01	0.26777189E 04
BODY	3	0.77753568E 01	0.28892167E 01	0.26593436E 04
BODY	4	0.88188551E 01	0.21086342E 01	0.26403533E 04
BODY	5	0.90432105E 01	0.12262842E 01	0.26217340E 04
BODY	6	0.13235671E 02	0.16919418E 01	0.25957631E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.40223250E 03	0.48914864E 03	0.56980873E 03
BODY	2	0.34862112E 03	0.40223250E 03	0.46522031E 03
BODY	3	0.29982373E 03	0.34862112E 03	0.41236120E 03
BODY	4	0.19378576E 03	0.29982373E 03	0.36744532E 03
BODY	5	0.27523159E 03	0.25859425E 03	0.32155871E 03
BODY	6	0.25859425E 03	0.19378576E 03	0.27853385E 03

```
FINAL PRODUCT FLOW RATE =              40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =      110595.55 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =       26627.16 KGS/HR
STEAM ECONOMY =              4.1535 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  6
FLOW ORDER    5  6  4  3  2  1
IFEED ARRAY  2  3  4  6  7  5
DESIGN = 1.00                           FCHEAT = 1.00
STEAM TEMP. = 135.56                    FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO  1 =  1.0000
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLFED  0                               KALBPR  1
TOTAL FEED FLOW RATE =       151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  1               IFSORD ARRAY  5
FEED STREAM  1                             151063.00
MULTIPLE FEED STREAM TO BODY  1               0.00
MULTIPLE FEED STREAM TO BODY  2               0.00
MULTIPLE FEED STREAM TO BODY  3               0.00
MULTIPLE FEED STREAM TO BODY  4               0.00
MULTIPLE FEED STREAM TO BODY  5               0.00
MULTIPLE FEED STREAM TO BODY  6               0.00

                    H T COEFF            AREA              H T RATE
BODY  1         0.11805000E 01      0.76016418E 03      0.14135155E 05
BODY  2         0.22259300E 01      0.76011358E 03      0.13262574E 05
BODY  3         0.21918600E 01      0.76012219E 03      0.13569081E 05
BODY  4         0.17943700E 01      0.76013045E 03      0.12593938E 05
BODY  5         0.13628200E 01      0.76010398E 03      0.98156691E 04
BODY  6         0.10789000E 01      0.76009646E 03      0.11271894E 05
                    VAPOR FLOW          PRODUCT           MASS FRACTION
BODY  1         0.20664925E 05      0.41924771E 05      0.50192464E 00
BODY  2         0.18991425E 05      0.62589426E 05      0.33620816E 00
BODY  3         0.18941278E 05      0.81580574E 05      0.25794224E 00
BODY  4         0.13985352E 05      0.10052158E 06      0.20933888E 00
BODY  5         0.15881522E 05      0.13518073E 06      0.15566624E 00
BODY  6         0.20673698E 05      0.11450730E 06      0.18377060E 00
                    TEMP C              TEMP TIN          TEMP TOUT
BODY  1         0.13556000E 03      0.10471425E 03      0.11980831E 03
BODY  2         0.11255284E 03      0.92221358E 02      0.10471425E 03
BODY  3         0.10036567E 03      0.79994915E 02      0.92221358E 02
BODY  4         0.89228310E 02      0.53385707E 02      0.79994915E 02
BODY  5         0.77839554E 02      0.71110000E 02      0.68363916E 02
BODY  6         0.67130778E 02      0.68363916E 02      0.53385707E 02
                    TEMP DIFF           BPRISE            ENTHALPY V
BODY  1         0.15751691E 02      0.72554672E 01      0.27022612E 04
BODY  2         0.78385875E 01      0.43485856E 01      0.26807211E 04
BODY  3         0.81443086E 01      0.29930473E 01      0.26617767E 04
BODY  4         0.92333949E 01      0.21553605E 01      0.26420496E 04
BODY  5         0.94756367E 01      0.12331381E 01      0.26226720E 04
BODY  6         0.13745071E 02      0.17157104E 01      0.25957880E 04
```

	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY L
BODY 1	0.41270006E 03	0.49792035E 03	0.56980873E 03
BODY 2	0.35542156E 03	0.41270006E 03	0.47190971E 03
BODY 3	0.30405610E 03	0.35540156E 03	0.42038152E 03
BODY 4	0.19366454E 03	0.30405610E 03	0.37347538E 03
BODY 5	0.27523159E 03	0.26084864E 03	0.32563740E 03
BODY 6	0.26084864E 03	0.19366454E 03	0.28076568E 03

NLORD ARRAY = 3

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467453E 05	0.14573458E 04
	MASS FRACTION	PPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 2 3

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23575090E 05	0.74213531E 03
CONDENSATE FLASH TANK 2	0.22902830E 05	0.67226012E 03

```
FINAL PRODUCT FLOW RATE =          40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =  110595.55 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   24317.23 KGS/HR
STEAM ECONOMY =            4.5480 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 3

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  6
FLOW ORDER    6  5  4  3  2  1
IFEED ARRAY   2  3  4  9  7  7
DESIGN = 1.00                           FCHEAT = 1.00
STEAM TEMP. = 135.56                    FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO  1 = 1.0000
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0                      FINISHER EFFECT   0
IRLFED  0                               KALBPR  1
TOTAL FEED FLOW RATE =      151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  6  5
FEED STREAM  1                                75531.50
FEED STREAM  2                                75531.50
MULTIPLE FEED STREAM TO BODY   1               0.00
MULTIPLE FEED STREAM TO BODY   2               0.00
MULTIPLE FEED STREAM TO BODY   3               0.00
MULTIPLE FEED STREAM TO BODY   4               0.00
MULTIPLE FEED STREAM TO BODY   5               0.00
MULTIPLE FEED STREAM TO BODY   6               0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.11805000E 01	0.77185619E 03	0.13888681E 05
BODY	2	0.22259300E 01	0.77181620E 03	0.13017837E 05
BODY	3	0.21918600E 01	0.77183545E 03	0.13316412E 05
BODY	4	0.17943700E 01	0.77184395E 03	0.12361909E 05
BODY	5	0.13628200E 01	0.77183696E 03	0.10460331E 05
BODY	6	0.10789000E 01	0.77184581E 03	0.11682528E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.20318922E 05	0.41904208E 05	0.50217094E 00
BODY	2	0.18666389E 05	0.62223373E 05	0.33818604E 00
BODY	3	0.18629548E 05	0.80889725E 05	0.26014523E 00
BODY	4	0.15058468E 05	0.99519165E 05	0.21144747E 00
BODY	5	0.16401146E 05	0.59130312E 05	0.17793814E 00
BODY	6	0.20084272E 05	0.55447420E 05	0.18975703E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.10548030E 03	0.12031741E 03
BODY	2	0.11305758E 03	0.93225975E 02	0.10548030E 03
BODY	3	0.10109733E 03	0.81269155E 02	0.93225975E 02
BODY	4	0.90194891E 02	0.61774089E 02	0.81269155E 02
BODY	5	0.79077507E 02	0.71110000E 02	0.69133043E 02
BODY	6	0.67517536E 02	0.71110000E 02	0.53488588E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.15242585E 02	0.72598330E 01	0.27030149E 04
BODY	2	0.75772820E 01	0.43829644E 01	0.26818881E 04
BODY	3	0.78713587E 01	0.30310837E 01	0.26633749E 04
BODY	4	0.89257358E 01	0.21916473E 01	0.26441767E 04
BODY	5	0.99444636E 01	0.16155071E 01	0.26237467E 04
BODY	6	0.14028948E 02	0.18185913E 01	0.25958957E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.41677853E 03	0.50138808E 03	0.56980873E 03
BODY	2	0.36011731E 03	0.41677853E 03	0.47404774E 03
BODY	3	0.30956985E 03	0.36011731E 03	0.42347055E 03
BODY	4	0.22798932E 03	0.30956985E 03	0.37754210E 03
BODY	5	0.27523159E 03	0.26066842E 03	0.33083093E 03
BODY	6	0.27523159E 03	0.19313964E 03	0.28238476E 03

NLORD ARRAY = 3

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467455E 05	0.14368025E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 2 3

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23187049E 05	0.70615928E 03
CONDENSATE FLASH TANK 2	0.22536374E 05	0.65067492E 03

```
FINAL PRODUCT FLOW RATE =            40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    110595.55 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     23893.21 KGS/HR
STEAM ECONOMY =              4.6287 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

PLANT NO. 4

NUMBER OF EFFECTS 6	NUMBER OF BODIES 6

```
NUMBER OF EFFECTS   6              NUMBER OF BODIES   6
FLOW ORDER    6   5   4   3   2   1
IFEED ARRAY   2   3   4   9   7   7
DESIGN =  1.00                     FCHEAT  =  1.00
STEAM TEMP. =  135.56              FEED TEMP. =   71.11
CONDENSATE TEMP. =    51.67        RADIATION LOSS FRACTION= 0.030
AREA RATIO  1 =   1.0000
LIQUOR FLASH TANK   1              CONDENSATE FLASH TANK   2
INTEGRAL HEATER   0               FINISHER EFFECT   1
IBLEED   0                         KALBPR   1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139         MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS   2         IFSORD ARRAY   6   5
FEED STREAM   1                          75531.50
FEED STREAM   2                          75531.50
MULTIPLE FEED STREAM TO BODY   1          0.00
MULTIPLE FEED STREAM TO BODY   2          0.00
MULTIPLE FEED STREAM TO BODY   3          0.00
MULTIPLE FEED STREAM TO BODY   4          0.00
MULTIPLE FEED STREAM TO BODY   5          0.00
MULTIPLE FEED STREAM TO BODY   6          0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.11805000E 01	0.73195775E 03	0.11304454E 05
BODY 2	0.22259300E 01	0.73192827E 03	0.10713381E 05
BODY 3	0.21918600E 01	0.73191266E 03	0.13382220E 05
BODY 4	0.17943700E 01	0.73192132E 03	0.13099321E 05
BODY 5	0.13628200E 01	0.73191570E 03	0.11012650E 05
BODY 6	0.10789000E 01	0.73191882E 03	0.12184655E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.16387045E 05	0.47297689E 05	0.44490706E 00
BODY 2	0.14986878E 05	0.63684402E 05	0.33042747E 00
BODY 3	0.18594392E 05	0.78671356E 05	0.26748078E 00
BODY 4	0.15882293E 05	0.97265816E 05	0.21634606E 00
BODY 5	0.17073155E 05	0.58458178E 05	0.17998402E 00
BODY 6	0.20841444E 05	0.54690082E 05	0.19238475E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.10965281E 03	0.12247729E 03
BODY 2	0.11622858E 03	0.97062935E 02	0.10965281E 03
BODY 3	0.10540466E 03	0.83931082E 02	0.97062935E 02
BODY 4	0.93905152E 02	0.62609111E 02	0.83931082E 02
BODY 5	0.81655116E 02	0.71110000E 02	0.70614526E 02
BODY 6	0.68963873E 02	0.71110000E 02	0.53533759E 02
	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.13082706E 02	0.62487143E 01	0.27066293E 04
BODY 2	0.65757684E 01	0.42481451E 01	0.26883546E 04
BODY 3	0.83417296E 01	0.31577833E 01	0.26694229E 04
BODY 4	0.99740694E 01	0.22759653E 01	0.26485853E 04
BODY 5	0.11040590E 02	0.16506524E 01	0.26263000E 04
BODY 6	0.15430114E 02	0.18637610E 01	0.25959430E 04

	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.44153504E 03	0.51583048E 03	0.569808873E 03
BODY 2	0.37849733E 03	0.44053504E 03	0.48748825E 03
BODY 3	0.32115229E 03	0.37849733E 03	0.44166634E 03
BODY 4	0.23107013E 03	0.32115229E 03	0.39316312E 03
BODY 5	0.27523159E 03	0.26677138E 03	0.34164941E 03
BODY 6	0.27523159E 03	0.19290910E 03	0.28844041E 03

NLCRD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467454E 05	0.13005614E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 2 3

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.18952650E 05	0.49481700E 03
CONDENSATE FLASH TANK 2	0.18490141E 05	0.46250842E 03

NVORD = 3
NUMBER OF LIQUOR FLASH TANK BEFORE FINISHER 0
FINISHER CONDENSATE FLASH TANK 2
RADIATION LOSS FRACTION IN FINISHER = 0.0150

STEAM TEMP. =	176.670	LIQUOR TEMP. =	112.694
TEMP. DIFF. =	63.976	BPRFIN =	7.289
ENTHALPY HLFINO =	0.45056349E 03	ENTHALPY VFINO =	0.26915373E 04
PRODUCT =	0.41767912E 05	VAPOR FLOW =	0.55297763E 04
MASS FRACTION =	0.50380961E 00	H T RATE =	0.25847517E 04
H T COEFF =	0.85176000E 00	AREA =	0.47433091E 02

NFCORD ARRAY = 2 3

FINISHER	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.41655357E 04	0.49791303E 03
CONDENSATE FLASH TANK 2	0.40638826E 04	0.10165309E 03

FINAL PRODUCT FLOW RATE =	40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =	110595.55 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =	19447.47 KGS/HR
STEAM REQUIRED IN FINISHER EFFECT =	4663.45 KGS/HR
STEAM ECONOMY =	4.5869 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =	6

```
NUMBER OF EFFECTS  6              NUMBER OF BODIES  7
FLOW ORDER    6  7  5  4  3  2  1
IFEED ARRAY   2  3  4  5  7  8  6
DESIGN = 1.00                     FCHEAT = 1.00
STEAM TEMP. = 135.56              FEED TEMP. =   71.11
CONDENSATE TEMP. =    51.67       RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO   1 =  0.5000
NAA          1 =  2
LIQUOR FLASH TANK  1             CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0               FINISHER EFFECT   0
IBLEED  0                        KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139       MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  1        IFSORD ARRAY   6
FEED STREAM  1                      151063.00
MULTIPLE FEED STREAM TO BODY  1         0.00
MULTIPLE FEED STREAM TO BODY  2         0.00
MULTIPLE FEED STREAM TO BODY  3         0.00
MULTIPLE FEED STREAM TO BODY  4         0.00
MULTIPLE FEED STREAM TO BODY  5         0.00
MULTIPLE FEED STREAM TO BODY  6         0.00
MULTIPLE FEED STREAM TO BODY  7         0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.37523346E 03	0.56051560E 04
BODY 2	0.13741700E 01	0.37520546E 03	0.85871749E 04
BODY 3	0.22259300E 01	0.75042468E 03	0.13328216E 05
BODY 4	0.21918600E 01	0.75040068E 03	0.13596868E 05
BODY 5	0.17943700E 01	0.75039829E 03	0.12608576E 05
BODY 6	0.13628200E 01	0.75038099E 03	0.98028077E 04
BODY 7	0.10789000E 01	0.75038157E 03	0.11243876E 05

	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.88241071E 04	0.41948814E 05	0.50163697E 00
BODY 2	0.11803581E 05	0.50772257E 05	0.41446012E 00
BODY 3	0.19078984E 05	0.62575176E 05	0.33628473E 00
BODY 4	0.18961867E 05	0.81654014E 05	0.25771024E 00
BODY 5	0.13953241E 05	0.10061594E 06	0.20914255E 00
BODY 6	0.15825116E 05	0.13523719E 06	0.15560125E 00
BODY 7	0.20667460E 05	0.11456974E 06	0.18367044E 00

	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.11890515E 03	0.12044140E 03
BODY 2	0.13556000E 03	0.10521194E 03	0.11890515E 03
BODY 3	0.11319103E 03	0.92595309E 02	0.10521194E 03
BODY 4	0.10086202E 03	0.80242249E 02	0.92595309E 02
BODY 5	0.89606267E 02	0.53383988E 02	0.80242249E 02
BODY 6	0.78090267E 02	0.71110000E 02	0.68504427E 02
BODY 7	0.67272404E 02	0.68504427E 02	0.53383988E 02

	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.15118601E 02	0.72503681E 01	0.27347313E 04
BODY 2	0.16654849E 02	0.57141208E 01	0.27015948E 04
BODY 3	0.79790907E 01	0.43499164E 01	0.26814900E 04
BODY 4	0.82667129E 01	0.29890421E 01	0.26623827E 04
BODY 5	0.93640175E 01	0.21519822E 01	0.26424699E 04
BODY 6	0.95858397E 01	0.12320229E 01	0.26229179E 04
BODY 7	0.13888415E 02	0.17139894E 01	0.25957862E 04
	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.49281313E 03	0.50223673E 03	0.56980873E 03
BODY 2	0.41543469E 03	0.49281313E 03	0.56980873E 03
BODY 3	0.35728644E 03	0.41543469E 03	0.47461308E 03
BODY 4	0.30520979E 03	0.35728644E 03	0.42247703E 03
BODY 5	0.19367333E 03	0.30520979E 03	0.37506544E 03
BODY 6	0.27523159E 03	0.26146246E 03	0.32668909E 03
BODY 7	0.26146246E 03	0.19367333E 03	0.28135855E 03

NLORD ARRAY =   4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467633E 05	0.14811889E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23629203E 05	0.78657699E 03
CONDENSATE FLASH TANK 2	0.23017619E 05	0.61158288E 03

```
FINAL PRODUCT FLOW RATE =           40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =          9642.40 KGS/HR
STEAM REQUIRED IN BODY(2) =         14773.38 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    24415.78 KGS/HR
STEAM ECONOMY =              4.5297 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

PLANT NO. 6

NUMBER OF EFFECTS 6		NUMBER OF BODIES 7
FLOW ORDER 7 6 5 4 3 2 1		
IFEED ARRAY 2 3 4 5 6 7 8		
DESIGN = 1.00		FCHEAT = 1.00
STEAM TEMP. = 135.56		FEED TEMP. = 71.11
CONDENSATE TEMP. = 51.67		RADIATION LOSS FRACTION= 0.030

AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO 1 = 0.5000
NAA 1 = 2

LIQUOR FLASH TANK 1	CONDENSATE FLASH TANK 2
INTEGRAL HEATER 0	FINISHER EFFECT 0
IBLEED 0	KALBPR 1

TOTAL FEED FLOW RATE = 151063.00

MASS FRACTION FEED = 0.139	MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS 1	IFSORD ARRAY 7
FEED STREAM 1	151063.00
MULTIPLE FEED STREAM TO BODY 1	0.00
MULTIPLE FEED STREAM TO BODY 2	0.00
MULTIPLE FEED STREAM TO BODY 3	0.00
MULTIPLE FEED STREAM TO BODY 4	0.00
MULTIPLE FEED STREAM TO BODY 5	0.00
MULTIPLE FEED STREAM TO BODY 6	0.00
MULTIPLE FEED STREAM TO BODY 7	0.00

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.37572601E 03	0.55347098E 04
BODY 2	0.13741700E 01	0.37569194E 03	0.84823817E 04
BODY 3	0.22259300E 01	0.75141365E 03	0.13152369E 05
BODY 4	0.21918600E 01	0.75139601E 03	0.13417458E 05
BODY 5	0.17943700E 01	0.75138538E 03	0.12439380E 05
BODY 6	0.13628200E 01	0.75138107E 03	0.11393220E 05
BODY 7	0.10789000E 01	0.75137436E 03	0.10376026E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.87160511E 04	0.41940860E 05	0.50173210E 00
BODY 2	0.11655449E 05	0.50656128E 05	0.41541027E 00
BODY 3	0.18829698E 05	0.62310795E 05	0.33771156E 00
BODY 4	0.18721930E 05	0.81140205E 05	0.25934216E 00
BODY 5	0.16462794E 05	0.99862288E 05	0.21072094E 00
BODY 6	0.14160220E 05	0.11632550E 06	0.18089821E 00
BODY 7	0.20576347E 05	0.13048642E 06	0.16126640E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.11912970E 03	0.12065098E 03
BODY 2	0.13556000E 03	0.10553547E 03	0.11912970E 03
BODY 3	0.11339892E 03	0.93013924E 02	0.10553547E 03
BODY 4	0.10116075E 03	0.80770481E 02	0.93013924E 02
BODY 5	0.89996706E 02	0.67465112E 02	0.80770481E 02
BODY 6	0.78591336E 02	0.52999240E 02	0.67465112E 02
BODY 7	0.65798753E 02	0.71110000E 02	0.52999240E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14909019E 02	0.72520544E 01	0.27347331E 04
BODY	2	0.16430300E 02	0.57307741E 01	0.27019203E 04
BODY	3	0.78634550E 01	0.43747167E 01	0.26819774E 04
BODY	4	0.81468282E 01	0.30172173E 01	0.26630414E 04
BODY	5	0.92262242E 01	0.21791440E 01	0.26433442E 04
BODY	6	0.11126223E 02	0.16663582E 01	0.26207978E 04
BODY	7	0.12799514E 02	0.13292446E 01	0.25953835E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.49422280E 03	0.50366864E 03	0.56980873E 03
BODY	2	0.41711767E 03	0.49422280E 03	0.56980873E 03
BODY	3	0.35916170E 03	0.41711767E 03	0.47549385E 03
BODY	4	0.30739328E 03	0.35916170E 03	0.42373832E 03
BODY	5	0.25301454E 03	0.30739328E 03	0.37670818E 03
BODY	6	0.19563343E 03	0.25301454E 03	0.32879115E 03
BODY	7	0.27523159E 03	0.19563343E 03	0.27519024E 03

NLORD ARRAY = 4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.40467802E 05	0.14730529E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 3 4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.23347699E 05	0.76664832E 03
CONDENSATE FLASH TANK	2	0.22747481E 05	0.60021745E 03

```
FINAL PRODUCT FLOW RATE =           40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =          9521.13 KGS/HR
STEAM REQUIRED IN BODY(2) =         14593.21 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    24114.35 KGS/HR
STEAM ECONOMY =                4.5863 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 7

```
NUMBER OF EFFECTS  6                      NUMBER OF BODIES  7
FLOW ORDER    6  5  7  4  3  2  1
IFEED ARRAY  2  3  4  7  8  8  10
DESIGN = 1.00                             FCHEAT = 1.00
STEAM TEMP. = 135.56                      FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67                RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =  0.5000
NAA         1 =  2
LIQUOR FLASH TANK  1                      CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                        FINISHER EFFECT  0
IBLEED  0                                 KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139               MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2                 IFSORD ARRAY  6  5
FEED STREAM  1                               75531.50
FEED STREAM  2                               75531.50
MULTIPLE FEED STREAM TO BODY  1               0.00
MULTIPLE FEED STREAM TO BODY  2               0.00
MULTIPLE FEED STREAM TO BODY  3               0.00
MULTIPLE FEED STREAM TO BODY  4               0.00
MULTIPLE FEED STREAM TO BODY  5               0.00
MULTIPLE FEED STREAM TO BODY  6               0.00
MULTIPLE FEED STREAM TO BODY  7               0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.98804000E 00	0.37594885E 03	0.58482815E 04
BODY	2	0.13741700E 01	0.37593291E 03	0.89537121E 04
BODY	3	0.22259300E 01	0.75183110E 03	0.13941763E 05
BODY	4	0.21918600E 01	0.75180562E 03	0.14221842E 05
BODY	5	0.17943700E 01	0.75181834E 03	0.10334686E 05
BODY	6	0.13628200E 01	0.75182539E 03	0.10110471E 05
BODY	7	0.10789000E 01	0.75180970E 03	0.11286312E 05

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.91979766E 04	0.41971659E 05	0.50136393E 00
BODY	2	0.12329076E 05	0.51169483E 05	0.41124269E 00
BODY	3	0.19958011E 05	0.63498406E 05	0.33139534E 00
BODY	4	0.15302004E 05	0.83456862E 05	0.25214314E 00
BODY	5	0.14742919E 05	0.60788652E 05	0.17308391E 00
BODY	6	0.15830183E 05	0.59701283E 05	0.17623638E 00
BODY	7	0.21730657E 05	0.98758975E 05	0.21307507E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11822785E 03	0.11981564E 03
BODY	2	0.13556000E 03	0.10423933E 03	0.11822785E 03
BODY	3	0.11257011E 03	0.91343836E 02	0.10423933E 03
BODY	4	0.99974367E 02	0.53889655E 02	0.91343836E 02
BODY	5	0.88450886E 02	0.71110000E 02	0.80790117E 02
BODY	6	0.79257982E 02	0.71110000E 02	0.69390283E 02
BODY	7	0.67804006E 02	0.75221413E 02	0.53889655E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.15744359E 02	0.72455288E 01	0.27347263E 04
BODY	2	0.17332146E 02	0.56577426E 01	0.27006145E 04
BODY	3	0.83307848E 01	0.42649581E 01	0.26800139E 04
BODY	4	0.86305304E 01	0.28929510E 01	0.26604133E 04
BODY	5	0.76607691E 01	0.15321331E 01	0.26437902E 04
BODY	6	0.98676988E 01	0.15862761E 01	0.26242153E 04
BODY	7	0.13914350E 02	0.22196599E 01	0.25963155E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.48859074E 03	0.49797413E 03	0.56980873E 03
BODY	2	0.41046150E 03	0.48859074E 03	0.56980873E 03
BODY	3	0.35180822E 03	0.41046150E 03	0.47198286E 03
BODY	4	0.19109104E 03	0.35180822E 03	0.41875511E 03
BODY	5	0.27523159E 03	0.31282710E 03	0.37020532E 03
BODY	6	0.27523159E 03	0.26204696E 03	0.33158820E 03
BODY	7	0.28766616E 03	0.19109104E 03	0.28358406E 03

NLORD ARRAY =   4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467057E 05	0.15047186E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.24611661E 05	0.85286452E 03
CONDENSATE FLASH TANK 2	0.23961845E 05	0.64981589E 03

FINAL PRODUCT FLOW RATE =   40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =   10060.80 KGS/HR
STEAM REQUIRED IN BODY(2) =   15403.73 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   25464.53 KGS/HR
STEAM ECONOMY =   4.3431 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6

```
NUMBER OF EFFECTS  6                          NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN = 1.00                                 FCHEAT = 1.00
STEAM TEMP. = 135.56                          FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67                    RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =  0.5000
NAA         1 =  2
LIQUOR FLASH TANK  1                          CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                            FINISHER EFFECT  0
IBLEED  0                                     KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139                    MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2                     IFSORD ARRAY  7  6
FEED STREAM  1                                   75531.50
FEED STREAM  2                                   75531.50
MULTIPLE FEED STREAM TO BODY  1                      0.00
MULTIPLE FEED STREAM TO BODY  2                      0.00
MULTIPLE FEED STREAM TO BODY  3                      0.00
MULTIPLE FEED STREAM TO BODY  4                      0.00
MULTIPLE FEED STREAM TO BODY  5                      0.00
MULTIPLE FEED STREAM TO BODY  6                      0.00
MULTIPLE FEED STREAM TO BODY  7                      0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.38109069E 03	0.54995253E 04
BODY 2	0.13741700E 01	0.38105250E 03	0.84412105E 04
BODY 3	0.22259300E 01	0.76212837E 03	0.13077865E 05
BODY 4	0.21918600E 01	0.76210722E 03	0.13339562E 05
BODY 5	0.17943700E 01	0.76209857E 03	0.12372535E 05
BODY 6	0.13628200E 01	0.76208282E 03	0.10450656E 05
BODY 7	0.10789000E 01	0.76208493E 03	0.11669121E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.86649231E 04	0.41927390E 05	0.50189328E 00
BODY 2	0.11614557E 05	0.50591506E 05	0.41594088E 00
BODY 3	0.18746871E 05	0.62205256E 05	0.33828453E 00
BODY 4	0.18645133E 05	0.80951839E 05	0.25994562E 00
BODY 5	0.15033531E 05	0.99597073E 05	0.21128207E 00
BODY 6	0.16366762E 05	0.59164077E 05	0.17783659E 00
BODY 7	0.20064096E 05	0.55467123E 05	0.18968963E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.11943946E 03	0.12095430E 03
BODY 2	0.13556000E 03	0.10599040E 03	0.11943946E 03
BODY 3	0.11369939E 03	0.93620031E 02	0.10599040E 03
BODY 4	0.10160573E 03	0.81544747E 02	0.93620031E 02
BODY 5	0.90592393E 02	0.61860861E 02	0.81544747E 02
BODY 6	0.79355946E 02	0.71110000E 02	0.69293516E 02
BODY 7	0.67679753E 02	0.71110000E 02	0.53487428E 02

		TEMP DIFF		BPRISE		ENTHALPY V	
BODY	1	0.14605699E	02	0.72549113E	01	0.27347361E	04
BODY	2	0.16120536E	02	0.57400750E	01	0.27023747E	04
BODY	3	0.77089855E	01	0.43846766E	01	0.26826743E	04
BODY	4	0.79856940E	01	0.30276370E	01	0.26640102E	04
BODY	5	0.90476451E	01	0.21888008E	01	0.26446424E	04
BODY	6	0.10062430E	02	0.16137627E	01	0.26240276E	04
BODY	7	0.14192325E	02	0.18174327E	01	0.25958945E	04
		ENTHALPY LIN		ENTHALPY LOUT		ENTHALPY C	
BODY	1	0.49618100E	03	0.50574476E	03	0.56980873E	03
BODY	2	0.41959592E	03	0.49618100E	03	0.56980873E	03
BODY	3	0.36208836E	03	0.41959592E	03	0.47676690E	03
BODY	4	0.31085503E	03	0.36208836E	03	0.42561723E	03
BODY	5	0.22836211E	03	0.31085503E	03	0.37921485E	03
BODY	6	0.27523159E	03	0.26137812E	03	0.33199926E	03
BODY	7	0.27523159E	03	0.19314555E	03	0.28306387E	03

NLORD ARRAY = 4

	PRODUCT		VAPOR FLOW	
LIQUOR FLASH TANK 1	0.40467726E	05	0.14596695E	04
	MASS FRACTION		BPRLFT	
LIQUOR FLASH TANK 1	0.52000000E	00	0.75762718E	01

NCORD ARRAY = 3 4

	PRODUCT		VAPOR FLOW	
CONDENSATE FLASH TANK 1	0.23234571E	05	0.74844164E	03
CONDENSATE FLASH TANK 2	0.22643244E	05	0.59132776E	03

```
FINAL PRODUCT FLOW RATE =              40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =      110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =             9460.56 KGS/HR
STEAM REQUIRED IN BODY(2) =            14522.45 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =       23983.01 KGS/HR
STEAM ECONOMY =                 4.6114 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

```
NUMBER OF EFFECTS  6              NUMBER OF BODIES  7
FLOW ORDER   7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  9  8
DESIGN = 1.00                    FCHEAT = 1.00
STEAM TEMP. = 135.56             FEED TEMP. =   71.11
CONDENSATE TEMP. =    51.67      RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 = .0.5000
NAA         1 =  2
LIQUOR FLASH TANK  1             CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0               FINISHER EFFECT  0
IBLEED  0                        KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139       MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2        IFSORD ARRAY  7  6
FEED STREAM   1                       50354.28
FEED STREAM   2                      100708.72
MULTIPLE FEED STREAM TO BODY  1           0.00
MULTIPLE FEED STREAM TO BODY  2           0.00
MULTIPLE FEED STREAM TO BODY  3           0.00
MULTIPLE FEED STREAM TO BODY  4           0.00
MULTIPLE FEED STREAM TO BODY  5           0.00
MULTIPLE FEED STREAM TO BODY  6           0.00
MULTIPLE FEED STREAM TO BODY  7           0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.98804000E 00	0.38568586E 03	0.54447986E 04
BODY	2	0.13741700E 01	0.38564371E 03	0.83688169E 04
BODY	3	0.22259300E 01	0.77131614E 03	0.12952149E 05
BODY	4	0.21918600E 01	0.77129518E 03	0.13209869E 05
BODY	5	0.17943700E 01	0.77128626E 03	0.12255453E 05
BODY	6	0.13628200E 01	0.77127456E 03	0.10742090E 05
BODY	7	0.10789000E 01	0.77127026E 03	0.11933909E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.85830908E 04	0.41913775E 05	0.50205632E 00
BODY	2	0.11525645E 05	0.50496015E 05	0.41672746E 00
BODY	3	0.18586136E 05	0.62020808E 05	0.33929057E 00
BODY	4	0.18492669E 05	0.80606633E 05	0.26105886E 00
BODY	5	0.15529972E 05	0.99099396E 05	0.21234312E 00
BODY	6	0.16793561E 05	0.83914393E 05	0.16717900E 00
BODY	7	0.19638471E 05	0.30715480E 05	0.22836535E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11976799E 03	0.12127193E 03
BODY	2	0.13556000E 03	0.10647019E 03	0.11976799E 03
BODY	3	0.11401413E 03	0.94254175E 02	0.10647019E 03
BODY	4	0.10206802E 03	0.82352044E 02	0.94254175E 02
BODY	5	0.91207314E 02	0.67190203E 02	0.82352044E 02
BODY	6	0.80144981E 02	0.71110000E 02	0.69925207E 02
BODY	7	0.68494467E 02	0.71110000E 02	0.54152955E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14288070E 02	0.72578011E 01	0.27347391E 04
BODY	2	0.15792008E 02	0.57538636E 01	0.27028544E 04
BODY	3	0.75439347E 01	0.44021660E 01	0.26834049E 04
BODY	4	0.78138502E 01	0.30468601E 01	0.26650162E 04
BODY	5	0.88552698E 01	0.22070620E 01	0.26459870E 04
BODY	6	0.10219773E 02	0.14307403E 01	0.26252541E 04
BODY	7	0.14341512E 02	0.24829604E 01	0.25965911E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.49826187E 03	0.50792371E 03	0.56980873E 03
BODY	2	0.42219117E 03	0.49826187E 03	0.56980873E 03
BODY	3	0.36510855E 03	0.42219117E 03	0.47810058E 03
BODY	4	0.31441199E 03	0.36510855E 03	0.42756949E 03
BODY	5	0.24540280E 03	0.31441199E 03	0.38180291E 03
BODY	6	0.27523159E 03	0.26577556E 03	0.33531044E 03
BODY	7	0.27523159E 03	0.18974465E 03	0.28647490E 03

NLORD ARRAY =   4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.40467777E 05	0.14460007E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.23037485E 05	0.72685921E 03
CONDENSATE FLASH TANK	2	0.22457354E 05	0.58013082E 03

FINAL PRODUCT FLOW RATE =   40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =   9366.37 KGS/HR
STEAM REQUIRED IN BODY(2) =   14397.97 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   23764.34 KGS/HR
STEAM ECONOMY =   4.6538 KGS VAPOR/KG STEAM
NUMBER OF ITERATICNS =   6

PLANT NO. 10

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN =  1.00                          FCHEAT =  1.00
STEAM TEMP. =  135.56                   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO CF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =   0.5000
NAA         1 =  2
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                             100708.57
FEED STREAM  2                              50354.43
MULTIPLE FEED STREAM TO BODY  1                 0.00
MULTIPLE FEED STREAM TO BODY  2                 0.00
MULTIPLE FEED STREAM TO BODY  3                 0.00
MULTIPLE FEED STREAM TO BODY  4                 0.00
MULTIPLE FEED STREAM TO BODY  5                 0.00
MULTIPLE FEED STREAM TO BODY  6                 0.00
MULTIPLE FEED STREAM TO BODY  7                 0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.38047659E 03	0.55554393E 04
BODY 2	0.13741700E 01	0.38044108E 03	0.85239611E 04
BODY 3	0.22259300E 01	0.76089946E 03	0.13216843E 05
BODY 4	0.21918600E 01	0.76087732E 03	0.13481416E 05
BODY 5	0.17943700E 01	0.76086979E 03	0.12506114E 05
BODY 6	0.13628200E 01	0.76085117E 03	0.10171105E 05
BODY 7	0.10789000E 01	0.76085773E 03	0.11370014E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.87506568E 04	0.41934078E 05	0.50181324E 00
BODY 2	0.11731100E 05	0.50683979E 05	0.41518200E 00
BODY 3	0.18943480E 05	0.62414324E 05	0.33715139E 00
BODY 4	0.18834348E 05	0.81357560E 05	0.25864930E 00
BODY 5	0.14569365E 05	0.10019201E 06	0.21002748E 00
BODY 6	0.15865505E 05	0.34488364E 05	0.20338374E 00
BODY 7	0.20434661E 05	0.80273657E 05	0.17476098E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.11925527E 03	0.12078199E 03
BODY 2	0.13556000E 03	0.10572500E 03	0.11925527E 03
BODY 3	0.11352850E 03	0.93276364E 02	0.10572500E 03
BODY 4	0.10136002E 03	0.81111012E 02	0.93276364E 02
BODY 5	0.90271109E 02	0.57876524E 02	0.81111012E 02
BODY 6	0.78943801E 02	0.71110000E 02	0.69134682E 02
BODY 7	0.67081778E 02	0.71110000E 02	0.53230931E 02

	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.14778009E 02	0.72534926E 01	0.27347346E 04
BODY 2	0.16304729E 02	0.57267731F 01	0.27021079E 04
BODY 3	0.78034917E 01	0.43649796E 01	0.26822747E 04
BODY 4	0.80836605E 01	0.30052545E 01	0.26634705E 04
BODY 5	0.91600968E 01	0.21672102E 01	0.26439259F 04
BODY 6	0.98091175E 01	0.20529034E 01	0.26234446E 04
BODY 7	0.13850847E 02	0.15609353E 01	0.25956260E 04
	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.49502034E 03	0.50456478E 03	0.56980873E 03
BODY 2	0.41820591E 03	0.49502034E 03	0.56980873E 03
BODY 3	0.36053566E 03	0.41820591E 03	0.47604283E 03
BODY 4	0.30904718E 03	0.36053566E 03	0.42457972E 03
BODY 5	0.21315722E 03	0.30904718E 03	0.37786283E 03
BODY 6	0.27523159E 03	0.25669089E 03	0.33026993E 03
BODY 7	0.27523159E 03	0.19445364E 03	0.28056057E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467660E 05	0.14664295E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23457235E 05	0.76431230E 03
CONDENSATE FLASH TANK 2	0.22856873E 05	0.60036161E 03

```
FINAL PRODUCT FLOW RATE =            40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =           9556.78 KGS/HR
STEAM REQUIRED IN BODY(2) =          14664.77 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     24221.55 KGS/HR
STEAM ECONOMY =              4.5660 KGS VAPOR/KG STEAM
NUMBER OF ITERATICNS =  6
```

PLANT NO. 11

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN = 1.00                           FCHEAT = 1.00
STEAM TEMP. =  135.56                   FEED TEMP. =   71.11
CONDENSATE TEMP. =    51.67             RADIATION LOSS FRACTION= 0.030
AREA RATIO CF BODY(1) TO BCDY(2) = 1.000
AREA RATIO   1 =   0.5000
NAA          1 =  .2
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  0
TOTAL FEED FLCW RATE =       151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                               75531.50
FEED STREAM  2                               75531.50
MULTIPLE FEED STREAM TO BODY  1               0.00
MULTIPLE FEED STREAM TO BODY  2               0.00
MULTIPLE FEED STREAM TO BODY  3               0.00
MULTIPLE FEED STREAM TO BODY  4               0.00
MULTIPLE FEED STREAM TO BODY  5               0.00
MULTIPLE FEED STREAM TO BODY  6               0.00
MULTIPLE FEED STREAM TO BODY  7               0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.29087403E 03	0.57684034E 04
BODY 2	0.13741700E 01	0.29086828E 03	0.80225600E 04
BODY 3	0.22259300E 01	0.58173520E 03	0.13336334E 05
BODY 4	0.21918600E 01	0.58172526E 03	0.13415910E 05
BODY 5	0.17943700E 01	0.58172949E 03	0.12377445E 05
BODY 6	0.13628200E 01	0.58172955E 03	0.10212895E 05
BODY 7	0.10789000E 01	0.58172540E 03	0.11459131E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.92545479E 04	0.41691566E 05	0.50473219E 00
BODY 2	0.11391076E 05	0.50946061E 05	0.41304617E 00
BODY 3	0.19447634E 05	0.62337085E 05	0.33756913E 00
BODY 4	0.18787250E 05	0.81784744E 05	0.25729830E 00
BODY 5	0.14642180E 05	0.10057201E 06	0.20923391E 00
BODY 6	0.15914843E 05	0.59616634E 05	0.17648661E 00
BODY 7	0.19933934E 05	0.55597504E 05	0.18924479E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.11548867E 03	0.11548867E 03
BODY 2	0.13556000E 03	0.10518956E 03	0.11548867E 03
BODY 3	0.11548867E 03	0.94667776E 02	0.10518956E 03
BODY 4	0.10518956E 03	0.82810146E 02	0.94667776E 02
BODY 5	0.94667776E 02	0.61396750E 02	0.82810146E 02
BODY 6	0.82810146E 02	0.71110000E 02	0.69927969E 02
BODY 7	0.69927969E 02	0.71110000E 02	0.51669999E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.20071330E 02	0.	0.27271424E 04
BODY	2	0.20071330E 02	0.	0.26990038E 04
BODY	3	0.10299108E 02	0.	0.26835802E 04
BODY	4	0.10521784E 02	0.	0.26673200E 04
BODY	5	0.11857631E 02	0.	0.26481256E 04
BODY	6	0.12882176E 02	0.	0.26262446E 04
BODY	7	0.18257970E 02	0.	0.25939922E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.47148104E 03	0.46886905E 03	0.56980873E 03
BODY	2	0.41521740E 03	0.47148104E 03	0.56980873E 03
BODY	3	0.36757546E 03	0.41521740E 03	0.48435075E 03
BODY	4	0.31695043E 03	0.36757546E 03	0.44075720E 03
BODY	5	0.22646413E 03	0.31695043E 03	0.39637612E 03
BODY	6	0.27523159E 03	0.26433575E 03	0.34649935E 03
BODY	7	0.27523159E 03	0.18585478E 03	0.29247781E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467419E 05	0.12240808E 04

	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.

NCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.22809644E 05	0.91549440E 03
CONDENSATE FLASH TANK 2	0.22366295E 05	0.44334903E 03

FINAL PRODUCT FLOW RATE =   40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =   9923.50 KGS/HR
STEAM REQUIRED IN BODY(2) =   13801.64 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   23725.14 KGS/HR
STEAM ECONOMY =   4.6615 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 7

PLANT NO. 12

```
NUMBER OF EFFECTS  6                      NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY   2  3  4  5 10  8  8
DESIGN = 1.00                             FCHEAT = 1.00
STEAM TEMP. = 135.56                      FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67                RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO   1 =   0.5000
NAA          1 =   2
LIQUOR FLASH TANK  1                      CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                        FINISHER EFFECT  0
IBLEED  1                                 KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139                MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2                 IFSORD ARRAY  7  6
FEED STREAM  1                               75531.50
FEED STREAM  2                               75531.50
MULTIPLE FEED STREAM TO BODY  1                  0.00
MULTIPLE FEED STREAM TO BODY  2                  0.00
MULTIPLE FEED STREAM TO BODY  3                  0.00
MULTIPLE FEED STREAM TO BODY  4                  0.00
MULTIPLE FEED STREAM TO BODY  5                  0.00
MULTIPLE FEED STREAM TO BODY  6                  0.00
MULTIPLE FEED STREAM TO BODY  7                  0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.98804000E 00	0.37893658E 03	0.60289940E 04
BODY	2	0.13741700E 01	0.37890786E 03	0.92334187E 04
BODY	3	0.22259300E 01	0.75786081E 03	0.13460432E 05
BODY	4	0.21918600E 01	0.75782941E 03	0.12814539E 05
BODY	5	0.17943700E 01	0.75781556E 03	0.11895793E 05
BODY	6	0.13628200E 01	0.75781090E 03	0.10035274E 05
BODY	7	0.10789000E 01	0.75782655E 03	0.11278836E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.94763180E 04	0.41920486E 05	0.50197595E 00
BODY	2	0.12825205E 05	0.51395867E 05	0.40943129E 00
BODY	3	0.19360591E 05	0.64220133E 05	0.32767101E 00
BODY	4	0.17848012E 05	0.83580509E 05	0.25177014E 00
BODY	5	0.14374851E 05	0.10142885E 06	0.20746638E 00
BODY	6	0.15782614E 05	0.59748409E 05	0.17609737E 00
BODY	7	0.19475531E 05	0.56055959E 05	0.18769705E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11782674E 03	0.11945711E 03
BODY	2	0.13556000E 03	0.10422156E 03	0.11782674E 03
BODY	3	0.11220073E 03	0.92306590E 02	0.10422156E 03
BODY	4	0.10002128E 03	0.80671892E 02	0.92306590E 02
BODY	5	0.89420076E 02	0.61590768E 02	0.80671892E 02
BODY	6	0.78548750E 02	0.71110000E 02	0.68831801E 02
BODY	7	0.67247912E 02	0.71110000E 02	0.53453180E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.16102889E 02	0.72563766E 01	0.27347376E 04
BODY	2	0.17733255E 02	0.56260110E 01	0.27000321E 04
BODY	3	0.79791762E 01	0.42002704E 01	0.26800328E 04
BODY	4	0.77146947E 01	0.28865140E 01	0.26619749E 04
BODY	5	0.87481835E 01	0.21231406E 01	0.26432138E 04
BODY	6	0.97169483E 01	0.15838885E 01	0.26232435E 04
BODY	7	0.13794732E 02	0.17831853E 01	0.25958586E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.48610672E 03	0.49553366E 03	0.56980873E 03
BODY	2	0.41065055E 03	0.48610672E 03	0.56980873E 03
BODY	3	0.35655586E 03	0.41065055E 03	0.47041842E 03
BODY	4	0.30740603E 03	0.35655586E 03	0.41892773E 03
BODY	5	0.22754560E 03	0.30740603E 03	0.37428211E 03
BODY	6	0.27523159E 03	0.25965576E 03	0.32861248E 03
BODY	7	0.27523159E 03	0.19332031E 03	0.28125603E 03

ICBLED =   0

	QBLEED	VBLEED
BLEED STREAM FROM BODY 1	0.	0.
BLEED STREAM FROM BODY 2	0.10000000E 04	0.16146294E 04
BLEED STREAM FROM BODY 3	0.10000000E 04	0.15921419E 04
BLEED STREAM FROM BODY 4	0.	0.
BLEED STREAM FROM BODY 5	0.	0.
BLEED STREAM FROM BODY 6	0.	0.
BLEED STREAM FROM BODY 7	0.	0.

NLORD ARRAY =   4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467988E 05	0.14524240E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.25357485E 05	0.89921235E 03
CONDENSATE FLASH TANK 2	0.24706398E 05	0.65108766E 03

```
FINAL PRODUCT FLOW RATE =              40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =      110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =            10371.51 KGS/HR
STEAM REQUIRED IN BODY(2) =            15885.19 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =       26256.70 KGS/HR
STEAM ECONOMY =            4.2121 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

PLANT NO. 13

```
NUMBER OF EFFECTS  6              NUMBER OF BODIES  7
FLOW ORDER   6  7  5  4  3  2  1
IFEED ARRAY  2  3  4  5  7  8  6
DESIGN =  1.00                   FCHEAT =  1.00
STEAM TEMP. =  135.56            FEED TEMP. =   71.11
CONDENSATE TEMP. =    51.67      RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =   0.5000
NAA         1 =  2
LIQUOR FLASH TANK  1             CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0               FINISHER EFFECT  0
IBLEED  0                        KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139       MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  1        IFSORD ARRAY  6
FEED STREAM  1                     100000.00
MULTIPLE FEED STREAM TO BODY  1        0.00
MULTIPLE FEED STREAM TO BODY  2        0.00
MULTIPLE FEED STREAM TO BODY  3        0.00
MULTIPLE FEED STREAM TO BODY  4        0.00
MULTIPLE FEED STREAM TO BODY  5        0.00
MULTIPLE FEED STREAM TO BODY  6        0.00
MULTIPLE FEED STREAM TO BODY  7     51063.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.37356471E 03	0.55201846E 04
BODY 2	0.13741700E 01	0.37353431E 03	0.84167666E 04
BODY 3	0.22259300E 01	0.74708600E 03	0.13067409E 05
BODY 4	0.21918600E 01	0.74705635E 03	0.12449571E 05
BODY 5	0.17943700E 01	0.74705716E 03	0.13050989E 05
BODY 6	0.13628200E 01	0.74703651E 03	0.10154799E 05
BODY 7	0.10789000E 01	0.74703838E 03	0.11421759E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.87011734E 04	0.43125912E 05	0.48794506E 00
BODY 2	0.11547291E 05	0.51826276E 05	0.40603102E 00
BODY 3	0.18787482E 05	0.63372757E 05	0.33205240E 00
BODY 4	0.17119997E 05	0.82160135E 05	0.25612270E 00
BODY 5	0.14496434E 05	0.99280521E 05	0.21195573E 00
BODY 6	0.16042922E 05	0.83956330E 05	0.16591959E 00
BODY 7	0.21241619E 05	0.11377768E 06	0.18494906E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.11916262E 03	0.12060408E 03
BODY 2	0.13556000E 03	0.10573824E 03	0.11916262E 03
BODY 3	0.11359616E 03	0.93858812E 02	0.10573824E 03
BODY 4	0.10146187E 03	0.81161241E 02	0.93858812E 02
BODY 5	0.90897176E 02	0.53405955E 02	0.81161241E 02
BODY 6	0.78960846E 02	0.71110000E 02	0.68986348E 02
BODY 7	0.67577229E 02	0.68986348E 02	0.53405955E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14955923E 02	0.70079158E 01	0.27344776E 04
BODY	2	0.16397375E 02	0.55664647E 01	0.27020403E 04
BODY	3	0.78579160E 01	0.42763729E 01	0.26823391E 04
BODY	4	0.76030569E 01	0.29616363E 01	0.26644301E 04
BODY	5	0.97359334E 01	0.22003947E 01	0.26439894E 04
BODY	6	0.99744974E 01	0.14091189E 01	0.26236347E 04
BODY	7	0.14171273E 02	0.17359603E 01	0.25958092E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.49452817E 03	0.50338773E 03	0.56980873E 03
BODY	2	0.41864105E 03	0.49452817E 03	0.56980873E 03
BODY	3	0.36369723E 03	0.41864105E 03	0.47632951E 03
BODY	4	0.30900427E 03	0.36369723E 03	0.42500977E 03
BODY	5	0.19356124E 03	0.30900427E 03	0.38049756E 03
BODY	6	0.27523159E 03	0.26191789E 03	0.33034145E 03
BODY	7	0.26191789E 03	0.19356124E 03	0.28263465E 03

NLORD ARRAY =   5

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.40467679E 05	0.26586258E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.23215702E 05	0.76074915E 03
CONDENSATE FLASH TANK	2	0.22626183E 05	0.58951940E 03

```
FINAL PRODUCT FLOW RATE =              40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =      110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =             9496.19 KGS/HR
STEAM REQUIRED IN BODY(2) =            14480.26 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =       23976.45 KGS/HR
STEAM ECONOMY =                  4.6127 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

NUMBER OF EFFECTS 6   NUMBER OF BODIES 7
FLOW ORDER   7 6 5 4 3 2 1
IFEED ARRAY 2 3 4 5 10 8 8
DESIGN = 1.00   FCHEAT = 1.00
STEAM TEMP. = 135.56   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67   RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO 1 = 0.5000
NAA   1 = 2
LIQUOR FLASH TANK 1   CONDENSATE FLASH TANK 2
INTEGRAL HEATER 5   FINISHER EFFECT 0
IBLEED 0   KALBPR 1
TOTAL FEED FLOW RATE =   151063.00
MASS FRACTION FEED = 0.139   MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS 2   IFSORD ARRAY 7 6
FEED STREAM 1   75531.50
FEED STREAM 2   75531.50
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00
MULTIPLE FEED STREAM TO BODY 4   0.00
MULTIPLE FEED STREAM TO BODY 5   0.00
MULTIPLE FEED STREAM TO BODY 6   0.00
MULTIPLE FEED STREAM TO BODY 7   0.00

		H T CCEFF	AREA	H T RATE
BODY	1	0.98804000E 00	0.38059986E 03	0.52531736E 04
BODY	2	0.13741700E 01	0.38059105E 03	0.80694527E 04
BODY	3	0.22259300E 01	0.76117478E 03	0.12943762E 05
BODY	4	0.21918600E 01	0.76113468E 03	0.13265122E 05
BODY	5	0.17943700E 01	0.76114480E 03	0.12341995E 05
BODY	6	0.13628200E 01	0.76110826E 03	0.11208089E 05
BODY	7	0.10789000E 01	0.76113716E 03	0.11681452E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.82852936E 04	0.41927155E 05	0.50189610E 00
BODY	2	0.11865558E 05	0.50212418E 05	0.41908110E 00
BODY	3	0.18676506E 05	0.62077946E 05	0.33897829E 00
BODY	4	0.18619595E 05	0.80754834E 05	0.26057977E 00
BODY	5	0.16231718E 05	0.99374369E 05	0.21175556E 00
BODY	6	0.16265912E 05	0.59265932E 05	0.17753096E 00
BODY	7	0.19190739E 05	0.56340898E 05	0.18674778E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.12013074E 03	0.12159057E 03
BODY	2	0.13556000E 03	0.11429870E 03	0.12013074E 03
BODY	3	0.11433561E 03	0.10125400E 03	0.10669612E 03
BODY	4	0.10229938E 03	0.88442581E 02	0.94348100E 02
BODY	5	0.91309512E 02	0.73539799E 02	0.82272890E 02
BODY	6	0.80075940E 02	0.71110000E 02	0.69270395E 02
BODY	7	0.67661882E 02	0.71110000E 02	0.53436868E 02

	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.13969427E 02	0.72549612E 01	0.27347361F 04
BODY 2	0.15429258E 02	0.57951304E 01	0.27033722E 04
BODY 3	0.76394945E 01	0.43967370E 01	0.26837553E 04
BODY 4	0.79512780E 01	0.30385870F 01	0.26651712F 04
BODY 5	0.90366217E 01	0.21969497E 01	0.26458605E C4
BODY 6	0.10805544E 02	0.16085128E 01	0.2623991CE 04
BODY 7	0.14225015E 02	0.17668712E 01	0.2595841 6E C4
	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.50055928E 03	0.51011392E 03	0.56980873E 03
BODY 2	0.45364390E 03	0.50055928E 03	0.56980873E C3
BODY 3	0.39239041E 03	0.42346974E 03	0.47946298E C3
BODY 4	0.33768668E 03	0.36562793E 03	0.42854656E 03
BODY 5	0.27743250E 03	0.31412990E 03	0.38223305E 03
BODY 6	0.27523159E 03	0.26132596E 03	0.33502068E 03
BODY 7	0.27523159E 03	0.19340356E 03	0.28298905E 03

IPRCCH = 0   SPECIFIED AREA RATIO = 0.080
IIH ARRAY = 0 0 1 1 1 1 1

			H T COEFF	AREA
INTEGRAL HEATER 1	IN BODY	3	0.22259300E 01	0.60893983E 02
INTEGRAL HEATER 2	IN BODY	4	0.21918600E 01	0.6089C774E 02
INTEGRAL HEATER 3	IN BODY	5	0.17943700E 01	0.60891584E 02
INTEGRAL HEATER 4	IN BODY	6	0.13628200E 01	0.60888661E 02
INTEGRAL HEATER 5	IN BODY	7	0.10789000E 01	0.60890973E 02
			TEMP TIHIN	TEMP TIHOUT
INTEGRAL HEATER 1	IN BODY	3	0.10669612E 03	0.1142987CE 03
INTEGRAL HEATER 2	IN BODY	4	0.94348100E 02	0.10125400E 03
INTEGRAL HEATER 3	IN BODY	5	0.82272890E 02	0.88442581E 02
INTEGRAL HEATER 4	IN BODY	6	0.66733541E 02	0.73539795E 02
INTEGRAL HEATER 5	IN BODY	7	0.53436868E 02	0.63878629E 02
			TEMP DIFF	H T RATE
INTEGRAL HEATER 1	IN BODY	3	0.76025867E 01	0.52031937E 03
INTEGRAL HEATER 2	IN BODY	4	0.69058971E 01	0.60033315E 03
INTEGRAL HEATER 3	IN BODY	5	0.61696911E 01	0.65026116E 03
INTEGRAL HEATER 4	IN BODY	6	0.68062592E 01	0.82456398E 03
INTEGRAL HEATER 5	IN BODY	7	0.10441761E 02	0.59145056E 03

NLORD ARRAY =   4

		PRODUCT	VAPOR FLOW
LIQUCR FLASH TANK	1	0.40466961E 05	0.14602198E 04
		MASS FRACTION	BPRLFT
LIQUCR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.22234170E 05	0.68528879E 03
CONDENSATE FLASH TANK	2	0.21668298E 05	0.56587238E 03

```
FINAL PRODUCT FLOW RATE =            40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    110595.55 KGS/HR
STEAM REQUIRED IN PODY(1) =           9037.12 KGS/HR
STEAM REQUIRED IN PODY(2) =          13882.34 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     22919.46 KGS/HR
STEAM ECONOMY =              4.8254 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   7
```

PLANT NO. 15

```
NUMBER OF EFFECTS   6              NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  9  8
DESIGN = 1.00                      FCHEAT = 1.00
STEAM TEMP. = 135.56               FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67         RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =  0.500
IAA         1 =  2
LIQUOR FLASH TANK  1               CONDENSATE FLASH TANK  2
INTEGRAL HEATER  5                 FINISHER EFFECT  0
IFLASH  0                          KALEPR  1
TOTAL FEED FLOW RATE =       151063.00
MASS FRACTION FEED = 0.139         MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2          IFSCRD ARRAY  7  6
FEED STREAM  1                          75531.50
FEED STREAM  2                          75531.50
MULTIPLE FEED STREAM TO BODY  1          0.00
MULTIPLE FEED STREAM TO BODY  2          0.00
MULTIPLE FEED STREAM TO BODY  3          0.00
MULTIPLE FEED STREAM TO BODY  4          0.00
MULTIPLE FEED STREAM TO BODY  5          0.00
MULTIPLE FEED STREAM TO BODY  6          0.00
MULTIPLE FEED STREAM TO BODY  7          0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.38151298E 03	0.52247448E 04
BODY 2	0.13741700E 01	0.38150157E 03	0.80286738E 04
BODY 3	0.22159300E 01	0.76298098E 03	0.12772119E 05
BODY 4	0.21918600E 01	0.76296422E 03	0.13142139E 05
BODY 5	0.17943700E 01	0.76296502E 03	0.12376382E 05
BODY 6	0.13628200E 01	0.76296215E 03	0.11590706E 05
BODY 7	0.10789000E 01	0.76295801E 03	0.11645165E 05

	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.82418302E 04	0.41917700E 05	0.50200931E 00
BODY 2	0.11643553E 05	0.50159428E 05	0.41952384E 00
BODY 3	0.18511592E 05	0.61802878E 05	0.34048698E 00
BODY 4	0.18693676E 05	0.80314519E 05	0.26200837E 00
BODY 5	0.16838153E 05	0.99008192E 05	0.21253873E 00
BODY 6	0.16157568E 05	0.59373762E 05	0.17720854E 00
BODY 7	0.19058651E 05	0.56472655E 05	0.18631208E 00

	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.12024535E 03	0.12169942E 03
BODY 2	0.13556000E 03	0.11293839E 03	0.12024535E 03
BODY 3	0.11444246E 03	0.10092741E 03	0.10692211E 03
BODY 4	0.10249914E 03	0.89769179E 02	0.94640473E 02
BODY 5	0.91577215E 02	0.77681027E 02	0.82537034E 02
BODY 6	0.80326605E 02	0.71110000E 02	0.69179337E 02
BODY 7	0.67576363E 02	0.71110000E 02	0.53429379E 02

		TEMP DIFF	RPRISE	ENTHALPY V
BODY	1	0.13463575E 02	0.72569679E 01	0.27347383E 04
BODY	2	0.15014648E 02	0.58028944E 01	0.27035379E 04
BODY	3	0.75003450E 01	0.44229670E 01	0.26840900E 04
BODY	4	0.78586704E 01	0.30632571E 01	0.26656251E 04
BODY	5	0.90401804E 01	0.22104287E 01	0.26462951E 04
BODY	6	0.11147267E 02	0.16029745E 01	0.26238361E 04
BODY	7	0.14046983E 02	0.17593834E 01	0.25958337E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.50028941E 03	0.51086351E 03	0.56980873E 03
BODY	2	0.44452199E 03	0.50128941E 03	0.56980873E 03
BODY	3	0.39030001E 03	0.42462903E 03	0.47991581E 03
BODY	4	0.34285776E 03	0.36692528E 03	0.42939027E 03
BODY	5	0.29305584E 03	0.31523584E 03	0.38335997E 03
BODY	6	0.27623159E 03	0.26058276E 03	0.33607270E 03
BODY	7	0.27623159E 03	0.19344175E 03	0.28263102E 03

IPRECH = 1
IIH ARRAY = 0 0 1 1 1 1 1

SPECIFIED TEMP. DIFF. RATIO= 0.800

		H T COEFF	AREA
INTEGRAL HEATER 1 IN BODY 3	0.22259300E 01	0.40829039E 02
INTEGRAL HEATER 2 IN BODY 4	0.21918600E 01	0.52616038E 02
INTEGRAL HEATER 3 IN BODY 5	0.17943700E 01	0.78051633E 02
INTEGRAL HEATER 4 IN BODY 6	0.13628200E 01	0.11877245E 03
INTEGRAL HEATER 5 IN BODY 7	0.10789000E 01	0.70188070E 02
	TEMP TIHIN	TEMP TIHOUT
INTEGRAL HEATER 1 IN BODY 3	0.10692211E 03	0.11293839E 03
INTEGRAL HEATER 2 IN BODY 4	0.94640473E 02	0.10092741E 03
INTEGRAL HEATER 3 IN BODY 5	0.82537034E 02	0.89769179E 02
INTEGRAL HEATER 4 IN BODY 6	0.67098714E 02	0.77681027E 02
INTEGRAL HEATER 5 IN BODY 7	0.53429379E 02	0.64746965E 02
	TEMP DIFF	H T RATE
INTEGRAL HEATER 1 IN BODY 3	0.60162763E 01	0.41018156E 03
INTEGRAL HEATER 2 IN BODY 4	0.62869368E 01	0.54379020E 03
INTEGRAL HEATER 3 IN BODY 5	0.72321443E 01	0.75966556E 03
INTEGRAL HEATER 4 IN BODY 6	0.10582312E 02	0.12846834E 04
INTEGRAL HEATER 5 IN BODY 7	0.11317586E 02	0.64277592E 03

NIORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467191E C5	0.14502240E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NOORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.22123633E 05	0.67678161E 03
CONDENSATE FLASH TANK 2	0.21565095E 05	0.55857747E 03

FINAL PRODUCT FLOW RATE =   40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =   8988.19 KGS/HR
STEAM REQUIRED IN BODY(2) =   13812.23 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   22800.41 KGS/HR
STEAM ECONOMY =   4.8506 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 7

PLANT NO. 16

```
NUMBER OF EFFECTS  6                  NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5  10  8  8
DESIGN =  1.00                        FCHEAT =  1.00
STEAM TEMP. =  135.56                 FEED TEMP. =    71.11
CONDENSATE TEMP. =    51.67           RADIATION LOSS FRACTION= 0.030
AREA RATIO CF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =  0.5000
NAA         1 =  2
LIQUOR FLASH TANK  1                  CONDENSATE FLASH TANK   2
INTEGRAL HEATER  5                    FINISHER EFFECT   1
IBLEED  0                             KALBPR  1
TOTAL FEED FLOW RATE =       151063.00
MASS FRACTION FEED = 0.139            MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2             IFSORD ARRAY  7  6
FEED STREAM  1                          75531.50
FEED STREAM  2                          75531.50
MULTIPLE FEED STREAM TO BODY  1            0.00
MULTIPLE FEED STREAM TO BODY  2            0.00
MULTIPLE FEED STREAM TO BODY  3            0.00
MULTIPLE FEED STREAM TO BODY  4            0.00
MULTIPLE FEED STREAM TO BODY  5            0.00
MULTIPLE FEED STREAM TO BODY  6            0.00
MULTIPLE FEED STREAM TO BODY  7            0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.98804000E 00	0.36357068E 03	0.42359558E 04
BODY 2	0.13741700E 01	0.36355079E 03	0.63763510E 04
BODY 3	0.22259300E 01	0.72716575E 03	0.10367860E 05
BODY 4	0.21918600E 01	0.72716603E 03	0.13175289E 05
BODY 5	0.17943700E 01	0.72716789E 03	0.13138107E 05
BODY 6	0.13628200E 01	0.72716999E 03	0.12258371E 05
BODY 7	0.10789000E 01	0.72715867E 03	0.12161521E 05

	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.67325111E 04	0.47310060E 05	0.44479072E 00
BODY 2	0.90942311E 04	0.54041924E 05	0.38938429E 00
BODY 3	0.14781238E 05	0.63135507E 05	0.33330018E 00
BODY 4	0.18697755E 05	0.77916497E 05	0.27007215E 00
BODY 5	0.17856129E 05	0.96614387E 05	0.21780478E 00
BODY 6	0.16831993E 05	0.58698902E 05	0.17924590E 00
BODY 7	0.19759600E 05	0.55771673E 05	0.18865379E 00

	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.12279659E 03	0.12376798E 03
BODY 2	0.13556000E 03	0.11624024E 03	0.12279659E 03
BODY 3	0.11752132E 03	0.10516462E 03	0.11111595E 03
BODY 4	0.10681789E 03	0.93335185E 02	0.98551543E 02
BODY 5	0.95348985E 02	0.80061679E 02	0.85279989E 02
BODY 6	0.82978910E 02	0.71110000E 02	0.70609234E 02
BODY 7	0.68971261E 02	0.71110000E 02	0.53469625E 02

		TEMP DIFF		BPRISE		ENTHALPY V	
BODY	1	0.11792016E	02	0.62466677E	01	0.27336808E	04
BODY	2	0.12763408E	02	0.52752753E	01	0.27074981E	04
BODY	3	0.64053696E	01	0.42980520E	01	0.26905551E	04
BODY	4	0.82663497E	01	0.32025585E	01	0.26717420E	04
BODY	5	0.10068995E	02	0.23010788E	01	0.26508142E	04
BODY	6	0.12369676E	02	0.16379722E	01	0.26262996E	04
BODY	7	0.15501636E	02	0.17996289E	01	0.25958759E	04
		ENTHALPY LIN		ENTHALPY LOUT		ENTHALPY C	
BODY	1	0.51745625E	03	0.52439663E	03	0.56980873E	03
BODY	2	0.46934097E	03	0.51745625E	03	0.56980873E	03
BODY	3	0.41168143E	03	0.44865070E	03	0.49297199E	03
BODY	4	0.35813862E	03	0.38579362E	03	0.44764065E	03
BODY	5	0.30258798E	03	0.32722984E	03	0.39924676E	03
BODY	6	0.27523159E	03	0.26686307E	03	0.34720811E	03
BODY	7	0.27523159E	03	0.19323641E	03	0.28847135E	03

IPRCCH = 1

IIH ARRAY = 0   0   1   1   1   1   1

SPECIFIED TEMP. DIFF. RATIO= 0.800

				H T COEFF		AREA	
INTEGRAL HEATER 1	IN BODY	3		0.22259300E	01	0.42416050E	02
INTEGRAL HEATER 2	IN BODY	4		0.21918600E	01	0.51539994E	02
INTEGRAL HEATER 3	IN BODY	5		0.17943700E	01	0.76519427E	02
INTEGRAL HEATER 4	IN BODY	6		0.13628200E	01	0.11757595E	03
INTEGRAL HEATER 5	IN BODY	7		0.10789000E	01	0.69191144E	02
				TEMP TIHIN		TEMP TIHOUT	
INTEGRAL HEATER 1	IN BODY	3		0.11111595E	03	0.11624024E	03
INTEGRAL HEATER 2	IN BODY	4		0.98551543E	02	0.10516462E	03
INTEGRAL HEATER 3	IN BODY	5		0.85279989E	02	0.93335185E	02
INTEGRAL HEATER 4	IN BODY	6		0.68392756E	02	0.80061679E	02
INTEGRAL HEATER 5	IN BODY	7		0.53469625E	02	0.65870933E	02
				TEMP DIFF		H T RATE	
INTEGRAL HEATER 1	IN BODY	3		0.51242952E	01	0.36285847E	03
INTEGRAL HEATER 2	IN BODY	4		0.66130791E	01	0.56030209E	03
INTEGRAL HEATER 3	IN BODY	5		0.80551958E	01	0.82950911E	03
INTEGRAL HEATER 4	IN BODY	6		0.11668923E	02	0.14023264E	04
INTEGRAL HEATER 5	IN BODY	7		0.12401309E	02	0.69432133E	03

NLORD ARRAY =   5

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.40468149E 05	0.13123117E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.17803521E 05	0.45332027E 03
CONDENSATE FLASH TANK	2	0.17406971E 05	0.39655028E 03

NVORD =   4
NUMBER OF LIQUOR FLASH TANK BEFORE FINISHER   0
FINISHER CONDENSATE FLASH TANK   2
RADIATION LOSS FRACTION IN FINISHER =   0.0150

STEAM TEMP. =	176.670	LIQUOR TEMP. =	114.104
TEMP. DIFF. =	62.566	BPRFIN =	7.286
ENTHALPY HLFINO =	0.45977674E 03	ENTHALPY VFINO =	0.26936828E 04
PRODUCT =	0.41780283E 05	VAPOR FLOW =	0.55297763E 04
MASS FRACTION =	0.50366043E 00	H T RATE =	0.25821750E 04
H T COEFF =	0.85176000E 00	AREA =	0.48454146E 02

NFCORD ARRAY =   3   4
FINISHER

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.41641575E 04	0.49464243E 03
CONDENSATE FLASH TANK	2	0.40714063E 04	0.92751191E 02

FINAL PRODUCT FLOW RATE =   40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =   7287.07 KGS/HR
STEAM REQUIRED IN BODY(2) =   10969.77 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   18256.84 KGS/HR
STEAM REQUIRED IN FINISHER EFFECT =   4658.80 KGS/HR
STEAM ECONOMY =   4.8262 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6

PLANT NO. 17

NUMBER OF EFFECTS 6   NUMBER OF BODIES 7
FLOW ORDER   7 6 5 4 3 2 1
IFEED ARRAY   2 3 4 5 10 8 8
DESIGN = 1.00   FCHEAT = 1.00
STEAM TEMP. = 135.56   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67   RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO 1 = 0.8000
AREA RATIO 2 = 0.5000
NAA   1 = 5
NAA   2 = 2
LIQUOR FLASH TANK 1   CONDENSATE FLASH TANK 2
INTEGRAL HEATER 5   FINISHER EFFECT 1
IBLEED 0   KALBPR 1
TOTAL FEED FLOW RATE =   151063.00
MASS FRACTION FEED = 0.139   MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS 2   IFSORD ARRAY 7 6
FEED STREAM 1   60000.00
FEED STREAM 2   60000.00
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00
MULTIPLE FEED STREAM TO BODY 4   0.00
MULTIPLE FEED STREAM TO BODY 5   31063.00
MULTIPLE FEED STREAM TO BODY 6   0.00
MULTIPLE FEED STREAM TO BODY 7   0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.98804000E 00	0.33562087E 03	0.42301048E 04
BODY	2	0.13741700E 01	0.33560577E 03	0.63287754E 04
BODY	3	0.22259300E 01	0.67126051E 03	0.10319042E 05
BODY	4	0.21918600E 01	0.67125738E 03	0.13104883E 05
BODY	5	0.17943700E 01	0.67125775E 03	0.13069099E 05
BODY	6	0.13628200E 01	0.83906336E 03	0.12073212E 05
BODY	7	0.10789000E 01	0.83906218E 03	0.12439666E 05

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.67121743E 04	0.47365933E 05	0.44426604E 00
BODY	2	0.89784361E 04	0.54077478E 05	0.38912827E 00
BODY	3	0.14602535E 05	0.63055284E 05	0.33372422E 00
BODY	4	0.18444144E 05	0.77657532E 05	0.27097276E 00
BODY	5	0.17438525E 05	0.96101815E 05	0.21896647E 00
BODY	6	0.17457891E 05	0.42541579E 05	0.19646661E 00
BODY	7	0.20063797E 05	0.39936102E 05	0.20928432E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.12183698E 03	0.12280361E 03
BODY	2	0.13556000E 03	0.11518494E 03	0.12183698E 03
BODY	3	0.11656617E 03	0.10357319E 03	0.10966001E 03
BODY	4	0.10535459E 03	0.91059399E 02	0.96447596E 02
BODY	5	0.93229473E 02	0.77514426E 02	0.82379107E 02
BODY	6	0.80058027E 02	0.71110000E 02	0.69499835E 02
BODY	7	0.67565894E 02	0.71110000E 02	0.53824418E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.12756386E 02	0.62374385E 01	0.27336711E 04
BODY	2	0.13723023E 02	0.52708012E 01	0.27060996E 04
BODY	3	0.69061623E 01	0.43054200E 01	0.26883382E 04
BODY	4	0.89069961E 01	0.32181218E 01	0.26684169E 04
BODY	5	0.10850365E 02	0.23210802E 01	0.26459605E 04
BODY	6	0.10558192E 02	0.19339403E 01	0.26241643E 04
BODY	7	0.13741476E 02	0.21544217E 01	0.25962472E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.51140206E 03	0.51798481E 03	0.56980873E 03
BODY	2	0.46258270E 03	0.51140206E 03	0.56980873E 03
BODY	3	0.40273790E 03	0.44039459E 03	0.48892007E 03
BODY	4	0.34666089E 03	0.37503047E 03	0.44145470E 03
BODY	5	0.28926732E 03	0.31361523E 03	0.39031706E 03
BODY	6	0.27523159E 03	0.25935857E 03	0.33494550E 03
BODY	7	0.27523159E 03	0.19142448E 03	0.28258720E 03

```
IPROCH =   1                        SPECIFIED TEMP. DIFF. RATIO= 0.800
IIH ARRAY =   0   0   1   1_1   1   1
```

			H T COEFF	AREA
INTEGRAL HEATER 1	IN BODY	3	0.22259300E 01	0.42134690E 02
INTEGRAL HEATER 2	IN BODY	4	0.21918600E 01	0.51024894E 02
INTEGRAL HEATER 3	IN BODY	5	0.17943700E 01	0.75515456E 02
INTEGRAL HEATER 4	IN BODY	6	0.13628200E 01	0.83647109E 02
INTEGRAL HEATER 5	IN BODY	7	0.10789000E 01	0.48757207E 02
			TEMP TIHIN	TEMP TIHOUT
INTEGRAL HEATER 1	IN BODY	3	0.10966001E 03	0.11518494E 03
INTEGRAL HEATER 2	IN BODY	4	0.96447596E 02	0.10357315E 03
INTEGRAL HEATER 3	IN BODY	5	0.82379107E 02	0.91059399E 02
INTEGRAL HEATER 4	IN BODY	6	0.67340026E 02	0.77514426E 02
INTEGRAL HEATER 5	IN BODY	7	0.53824418E 02	0.64817598E 02
			TEMP DIFF	H T RATE
INTEGRAL HEATER 1	IN BODY	3	0.55249290E 01	0.38863273E 03
INTEGRAL HEATER 2	IN BODY	4	0.71255970E 01	0.59769205E 03
INTEGRAL HEATER 3	IN BODY	5	0.86802921E 01	0.88215214E 03
INTEGRAL HEATER 4	IN BODY	6	0.10174400E 02	0.86988046E 03
INTEGRAL HEATER 5	IN BODY	7	0.10993180E 02	0.43371522E 03

```
NLORD ARRAY =  5
                                       PRODUCT              VAPOR FLOW
LIQUOR FLASH TANK   1            0.40468064E 05       0.13682677E C4
                                    MASS FRACTION          BPRLFT
LICLOR FLASH TANK   1            0.52000000E 00       0.75762718E 01

NCORD ARRAY =  3  4
                                       PRODUCT              VAPOR FLOW
CONDENSATE FLASH TANK   1        0.17680661E 05       0.48424927E 03
CONDENSATE FLASH TANK   2        0.17271019E 05       0.40964165E 03


NVORD =  4
NUMBER OF LIQUOR FLASH TANK BEFORE FINISHER   0
FINISHER CONDENSATE FLASH TANK   2
RADIATION LOSS FRACTION IN FINISHER =   0.0150
STEAM TEMP. =         176.670          LIQUOR TEMP. =   112.629
TEMP. DIFF. =          64.041          BPRFIN =           7.274
ENTHALPY HLFINO = 0.45017797E 03       ENTHALPY VFINO = 0.26914458E 04
PRODUCT =         0.41836156E 05       VAPOR FLOW =     0.55297762E 04
MASS FRACTION =   0.50298778E 00       H T RATE =       0.25505486E 04
H T COEFF =       0.85176000E 00       AREA =           0.46758182E 02

NFCCRD ARRAY =  3  4
FINISHER                               PRODUCT              VAPOR FLOW
CONDENSATE FLASH TANK   1        0.41051987E 04       0.49654038E 03
CONDENSATE FLASH TANK   2        0.40100857E 04       0.95112982E 02


FINAL PRODUCT FLOW RATE =               40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =       110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =              7277.04 KGS/HR
STEAM REQUIRED IN BODY(2) =             10887.87 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =        18164.91 KGS/HR
STEAM REQUIRED IN FINISHER EFFECT =      4601.74 KGS/HR
STEAM ECONOMY =                 4.8578 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

PLANT NO. 18

NUMBER OF EFFECTS 6   NUMBER OF BODIES 7
FLOW ORDER   7 6 5 4 3 2 1
IFEED ARRAY 2 3 4 5 10 8 8
DESIGN = 1.00   FCHEAT = 1.00
STEAM TEMP. =   135.56   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67   RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO 1 =   0.8000
AREA RATIO 2 =   0.5000
NAA   1 =   5
NAA   2 =   2
LIQUOR FLASH TANK 1   CONDENSATE FLASH TANK 2
INTEGRAL HEATER 5   FINISHER EFFECT 1
IBLEED 0   KALBPR 1
TOTAL FEED FLOW RATE =   151063.00
MASS FRACTION FEED = 0.139   MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS 2   IFSRC ARRAY 7 6
FEED STREAM 1   60000.00
FEED STREAM 2   60000.00
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00
MULTIPLE FEED STREAM TO BODY 4   0.00
MULTIPLE FEED STREAM TO BODY 5   31063.00
MULTIPLE FEED STREAM TO BODY 6   0.00
MULTIPLE FEED STREAM TO BODY 7   0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.98804000E 00	0.33562087E 03	0.42301048E 04
BODY	2	0.13741700E 01	0.33560577E 03	0.63287754E 04
BODY	3	0.22259300E 01	0.67126051E 03	0.10319042E 05
BODY	4	0.21918600E 01	0.67125738E 03	0.13104883E 05
BODY	5	0.17943700E 01	0.67125775E 03	0.13069099E 05
BODY	6	0.13628200E 01	0.83906336E 03	0.12073212E 05
BODY	7	0.10789000E 01	0.83906218E 03	0.12439666E 05

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.67121743E 04	0.47365933E 05	0.44426604E 00
BODY	2	0.89784361E 04	0.54077478E 05	0.38912827E 00
BODY	3	0.14602535E 05	0.63055284E 05	0.33372422E 00
BODY	4	0.18444144E 05	0.77657532E 05	0.27097276E 00
BODY	5	0.17438525E 05	0.96101815E 05	0.21896647E 00
BODY	6	0.17457891E 05	0.42541579E 05	0.19646661E 00
BODY	7	0.20063797E 05	0.39936102E 05	0.20928432E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.12183698E 03	0.12260361E 03
BODY	2	0.13556000E 03	0.11518494E 03	0.12183698E 03
BODY	3	0.11656617E 03	0.10357319E 03	0.10966001E 03
BODY	4	0.10535459E 03	0.91059399E 02	0.96447596E 02
BODY	5	0.93229473E 02	0.77514426E 02	0.82379107E 02
BODY	6	0.80058027E 02	0.71110000E 02	0.69499835E 02
BODY	7	0.67565894E 02	0.71110000E 02	0.53824418E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.12756386E 02	0.62374285E 01	C.27336711E C4
BODY	2	0.13723023E 02	0.52708012E 01	0.27060996E C4
BODY	3	0.69061623E 01	0.43054200E 01	C.26883382E C4
BODY	4	0.89069961E 01	0.32161218E 01	0.26684169E C4
BODY	5	0.10850365E 02	0.23210802E 01	C.26459605E C4
BODY	6	0.10558192E 02	0.19339403E 01	0.26241643E C4
BODY	7	0.13741476E 02	0.21544217E 01	0.25962472E C4

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.51140206E 03	0.51798481E 03	0.56980873E 03
BODY	2	0.46258270E 03	0.51140206E 03	0.56980873E C3
BODY	3	0.40273790E 03	0.44039459E 03	0.48892007E C3
BODY	4	0.34666089E 03	0.37503047E 03	0.44145470E 03
BODY	5	0.28926732E 03	0.31361523E 03	0.39031706E 03
BODY	6	0.27523159E 03	0.25935857E 03	0.33495550E 03
BODY	7	0.27523159E 03	0.19142448E 03	0.28258720E 03

IPRCCH = 1   SPECIFIED TEMP. DIFF. RATIO= C.800
IIH ARRAY = C 0 1 1 1 1 1

			H T CCEFF	AREA
INTEGRAL HEATER 1	IN BCCY	3	0.22259300E 01	0.42134690E C2
INTEGRAL HEATER 2	IN BCCY	4	0.21918600E 01	0.51024894E 02
INTEGRAL HEATER 3	IN BCCY	5	0.17943700E 01	0.75515456E C2
INTEGRAL HEATER 4	IN BCCY	6	0.13628200E 01	0.83647109E 02
INTEGRAL HEATER 5	IN BCCY	7	0.10789000E 01	0.48757207E C2

			TEMP TIHIN	TEMP TIHOUT
INTEGRAL HEATER 1	IN BCCY	3	0.10966001E 03	0.11518494E C3
INTEGRAL HEATER 2	IN BCCY	4	0.96447596E 02	0.10357319E C3
INTEGRAL HEATER 3	IN BCCY	5	0.82379107E 02	C.91059399E C2
INTEGRAL HEATER 4	IN BCCY	6	0.67340026E 02	0.77514426E 02
INTEGRAL HEATER 5	IN BCCY	7	0.53824418E 02	0.64817598E C2

			TEMP DIFF	H T RATE
INTEGRAL HEATER 1	IN BCCY	3	0.55249290E 01	0.38863273E C3
INTEGRAL HEATER 2	IN BCCY	4	0.71255970E 01	0.59769205E 03
INTEGRAL HEATER 3	IN BCCY	5	0.86802921E 01	0.88215214E 03
INTEGRAL HEATER 4	IN BCCY	6	0.10174400E 02	0.86956046E 03
INTEGRAL HEATER 5	IN BCCY	7	0.10993180E 02	0.43371522E C3

```
NLCRD ARRAY =  5
                                       PRCCUCT              VAPCR FLCW
LIQLCR FLASH TANK   1           0.40468064E 05       0.13662677E C4
                                     MASS FRACTION          BPRLFT
LIClCR FLASH TANK   1           0.52CCCCCOE 00       C.75762718E Cl

NCCRD ARRAY =  3  4
                                       PRCCLCT              VAPCR FLCW
CCNCENSATE FLASH TANK   1        0.17680661E 05       0.48424927E C3
CONCENSATE FLASH TANK   2        0.17271019E 05       0.40964165E 03

NVCRD =  4
NUMBER CF LICLCR FLASH TANK BEFCRE FINISHER   0
FINISHER CCNCENSATE FLASH TANK  2
RADIATICN LCSS FRACTICN IN FINISHER =    0.0150
STEAM TEMP. =        176.670             LICUCR TEMP. =     112.629
TEMP. DIFF. =         64.041             BPRFIN =             7.274
ENTHALPY HLFINC = 0.45017797E 03         ENTHALPY VFINC = 0.26914458E C4
PRCCUCT =        0.41836156E 05          VAPOR FLOW =     0.55297762E 04
MASS FRACTICN =  0.50298778E CO          H T RATE =       0.25905486E C4
H T CCEFF =      0.85176000E 00          AREA =           0.46756182E 02

NFCCRD ARRAY =  3  4
FINISHER                               PRCCUCT              VAPCR FLOW
CONCENSATE FLASH TANK   1        0.41051987E 04       0.49654038E 03
CONCENSATE FLASH TANK   2        0.40100857E 04       0.95112982E C2


FINAL PRCCLCT FLCW RATE =            40467.45 KGS/HR
TOTAL EVAPCRATICN IN THE PLANT =    110595.55 KGS/HR
STEAM RECLIREC IN BCCY(1) =           7277.04 KGS/HR
STEAM RECUIREC IN BCCY(2) =          10887.87 KGS/HR
TOTAL STEAM RECUIREC IN BCCIES =     18164.91 KGS/HR
STEAM RECLIREC IN FINISHER EFFECT =   4601.74 KGS/HR
STEAM ECCNCMY =              4.8578 KGS VAPCR/KG STEAM
NUMBER CF ITERATICNS =  6
```

PLANT NO. 19

```
NUMBER OF EFFECTS   3              NUMBER OF BODIES   3
FLOW ORDER    1   2   3
IFEED ARRAY   4   1   2
DESIGN =   1.00                    FCHEAT =   1.00
STEAM TEMP. =   117.90             FEED TEMP. =   37.79
CONDENSATE TEMP. =    51.67        RADIATION LOSS FRACTION= 0.000
AREA RATIO   1 =   1.0000
LIQUOR FLASH TANK   0              CONDENSATE FLASH TANK   0
INTEGRAL HEATER   0                FINISHER EFFECT   0
IBLEED   0                         KALBPR   0
TOTAL FEED FLOW RATE =        22680.00
MASS FRACTION FEED = 0.100         MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS   1         IFSORD ARRAY   1
FEED STREAM   1                         22680.00
MULTIPLE FEED STREAM TO BODY   1            0.00
MULTIPLE FEED STREAM TO BODY   2            0.00
MULTIPLE FEED STREAM TO BODY   3            0.00
```

```
               H T COEFF              AREA                H T RATE
BODY   1    0.34050000E 01     0.14272332E 03       0.52650774E 04
BODY   2    0.14190000E 01     0.14272100E 03       0.34413517E 04
BODY   3    0.71000000E 00     0.14271612E 03       0.38905169E 04
               VAPOR FLOW            PRODUCT            MASS FRACTION
BODY   1    0.55362669E 04     0.17143808E 05       0.13229266E 00
BODY   2    0.59610845E 04     0.11182564E 05       0.20281573E 00
BODY   3    0.66466476E 04     0.45360007E 04       0.50000000E 00
               TEMP C               TEMP TIN            TEMP TOUT
BODY   1    0.11790000E 03     0.37790000E 02       0.10705767E 03
BODY   2    0.10705767E 03     0.10705767E 03       0.90065113E 02
BODY   3    0.90065113E 02     0.90065113E 02       0.51670001E 02
               TEMP DIFF            BPRISE              ENTHALPY V
BODY   1    0.10842328E 02     0.               0.26864199E 04
BODY   2    0.16992559E 02     0.               0.26599935E 04
BODY   3    0.38395113E 02     0.               0.25939922E 04
               ENTHALPY LIN         ENTHALPY LOUT       ENTHALPY C
BODY   1    0.15821917E 03     0.44822906E 03       0.49457885E 03
BODY   2    0.44822906E 03     0.37708462E 03       0.44865453E 03
BODY   3    0.37708462E 03     0.21633196E 03       0.37659602E 03
```

```
FINAL PRODUCT FLOW RATE =            4536.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    18144.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     8591.09 KGS/HR
STEAM ECONOMY =            2.1120 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   4
```

PLANT NO. 20

NUMBER OF EFFECTS   3   NUMBER OF BODIES   3
FLOW ORDER   3 2 1
IFEED ARRAY 2 3 4
DESIGN =   1.00   FCHEAT =   1.00
STEAM TEMP. = 117.90   FEED TEMP. =   37.79
CONDENSATE TEMP. =   51.67   RADIATION LOSS FRACTION= 0.000
AREA RATIO 1 =   1.0000
LIQUOR FLASH TANK 0   CONDENSATE FLASH TANK   0
INTEGRAL HEATER 0   FINISHER EFFECT 0
IBLEED 0   KALBPR 0
TOTAL FEED FLOW RATE =   22680.00
MASS FRACTION FEED = 0.100   MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS 1   IFSORD ARRAY   3
FEED STREAM 1   22680.00
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00

	H T COEFF	AREA	H T RATE
BODY 1	0.22700000E 01	0.13632149E 03	0.46217564E 04
BODY 2	0.14190000E 01	0.13632952E 03	0.43234454E 04
BODY 3	0.99400000E 00	0.13632927E 03	0.39224587E 04
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.69211445E 04	0.45360004E 04	0.50000000E 00
BODY 2	0.58381992E 04	0.11457031E 05	0.19795704E 00
BODY 3	0.53846554E 04	0.17295218E 05	0.13113451E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.11790000E 03	0.80615620E 02	0.10296460E 03
BODY 2	0.10296460E 03	0.51669998E 02	0.80615620E 02
BODY 3	0.80615620E 02	0.37790000E 02	0.51669998E 02
	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.14935400E 02	0.	0.26801757E 04
BODY 2	0.22348978E 02	0.	0.26444657E 04
BODY 3	0.28945622E 02	0.	0.25939922E 04
	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.33752148E 03	0.43109218E 03	0.49457885E 03
BODY 2	0.21633195E 03	0.33752148E 03	0.43135628E 03
BODY 3	0.15821917E 03	0.21633195E 03	0.33728576E 03

FINAL PRODUCT FLOW RATE =   4536.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   18144.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   7535.65 KGS/HR
STEAM ECONOMY =   2.4078 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   4

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  6
FLOW ORDER    6  5  4  3  2  1
IFEED ARRAY  2  3  4  9  7  7
DESIGN = 1.00                           FCHEAT = 1.00
STEAM TEMP. = 137.90                    FEED TEMP. =   76.60
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO  1 =  1.0000
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  0
INTEGRAL HEATER  0                      FINISHER EFFECT  C
IBLEED  0                               KALBPR  0
TOTAL FEED FLOW RATE =         65200.00
MASS FRACTION FEED = 0.152              MASS FRACTION PRODUCT = 0.405
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  6  5
FEED STREAM  1                             32600.00
FEED STREAM  2                             32600.00
MULTIPLE FEED STREAM TO BODY  1                0.00
MULTIPLE FEED STREAM TO BODY  2                0.00
MULTIPLE FEED STREAM TO BODY  3                0.00
MULTIPLE FEED STREAM TO BODY  4                0.00
MULTIPLE FEED STREAM TO BODY  5                0.00
MULTIPLE FEED STREAM TO BODY  6                0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.14880000E 01	0.30274243E 03	0.55051821E 04
BODY	2	0.16740000E 01	0.30273947E 03	0.47518043E 04
BODY	3	0.14310000E 01	0.30273661E 03	0.41071107E 04
BODY	4	0.14250000E 01	0.30273848E 03	0.46346759E 04
BODY	5	0.12550000E 01	0.30273881E 03	0.37545151E 04
BODY	6	0.12550000E 01	0.30274066E 03	0.44632383E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.77491953E 04	0.26304883E 05	0.37675135E 00
BODY	2	0.63853203E 04	0.34054081E 05	0.29101946E 00
BODY	3	0.51326892E 04	0.40439462E 05	0.24506755E 00
BODY	4	0.52991697E 04	0.45572409E 05	0.21746491E 00
BODY	5	0.62523956E 04	0.26347621E 05	0.18807011E 00
BODY	6	0.80760998E 04	0.24523977E 05	0.20205532E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13790000E 03	0.11075296E 03	0.12567932E 03
BODY	2	0.12012932E 03	0.96822447E 02	0.11075296E 03
BODY	3	0.10630296E 03	0.82189166E 02	0.96822447E 02
BODY	4	0.92932446E 02	0.62184685E 02	0.82189166E 02
BODY	5	0.78859165E 02	0.76600000E 02	0.68977229E 02
BODY	6	0.66197228E 02	0.76600000E 02	0.54449995E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.12220683E 02	0.55500000E 01	0.27115623E 04
BODY	2	0.93763552E 01	0.44500000E 01	0.26899326E 04
BODY	3	0.94805131E 01	0.38900000E 01	0.26686490E 04
BODY	4	0.10743280E 02	0.33300000E 01	0.26450004E 04
BODY	5	0.98819359E 01	0.27800000E 01	0.26226605E 04
BODY	6	0.11747233E 02	0.27800000E 01	0.25969020E 04

	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.44871300E 03	0.53551806E 03	0.57982647E 03
BODY 2	0.37958206E 03	0.44871300E 03	0.50404321E 03
BODY 3	0.31294904E 03	0.37958206E 03	0.44546355E 03
BODY 4	0.22789366E 03	0.31294904E 03	0.38906613E 03
BODY 5	0.29724205E 03	0.25840737E 03	0.32991483E 03
BODY 6	0.29724205E 03	0.19511091E 03	0.27685801E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.24470124E 05	0.18350058E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.40500000E 00	0.61000000E 01

```
FINAL PRODUCT FLOW RATE =            24470.12 KGS/HR
TOTAL EVAPORATION IN THE PLANT =     40729.88 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =      9501.29 KGS/HR
STEAM ECONOMY =               4.2868 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  6
FLOW ORDER   6   5   4   3   2   1
IFEED ARRAY  2   3   4   9   7   7
DESIGN =  1.00                         FCHEAT =  1.00
STEAM TEMP. =  138.00                  FEED TEMP. =   80.00
CONDENSATE TEMP. =   54.50             RADIATION LOSS FRACTION= 0.500
AREA RATIO  1 =  0.800
NAA          1 =   3
LIQUOR FLASH TANK  1                   CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0                     FINISHER EFFECT   ·
IBLEED  0                              KALBPR  1
TOTAL FEED FLOW RATE =        86000.00
MASS FRACTION FEED = 0.150             MASS FRACTION PRODUCT = 0.72
NUMBER OF FEED STREAMS  2              IFSORD ARRAY  6   5
FEED STREAM  1                            34400.00
FEED STREAM  2                            51600.00
MULTIPLE FEED STREAM TO BODY   1              0.00
MULTIPLE FEED STREAM TO BODY   2              0.00
MULTIPLE FEED STREAM TO BODY   3              0.00
MULTIPLE FEED STREAM TO BODY   4              0.00
MULTIPLE FEED STREAM TO BODY   5              0.00
MULTIPLE FEED STREAM TO BODY   6              0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.90000000E 00	0.52991842E 03	0.74382256E 04
BODY 2	0.12500000E 01	0.52989379E 03	0.67368132E 04
BODY 3	0.13600000E 01	0.52988702E 03	0.69912489E 04
BODY 4	0.13550000E 01	0.66237097E 03	0.65830421E 04
BODY 5	0.12500000E 01	0.66236959E 03	0.58557392E 04
BODY 6	0.90000000E 00	0.66237124E 03	0.68940298E 04
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.10520519E 05	0.25910036E 05	0.49787658E 00
BODY 2	0.93183685E 04	0.36430450E 05	0.35409939E 00
BODY 3	0.98087087E 04	0.45748892E 05	0.28197405E 00
BODY 4	0.85297141E 04	0.55557621E 05	0.23219137E 00
BODY 5	0.99773095E 04	0.41622653E 05	0.18595643E 00
BODY 6	0.11935334E 05	0.22464720E 05	0.22969349E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13800000E 03	0.10504929E 03	0.12240383E 03
BODY 2	0.11522010E 03	0.90688119E 02	0.10504929E 03
BODY 3	0.10038948E 03	0.79945032E 02	0.90688119E 02
BODY 4	0.37279794E 02	0.66476633E 02	0.79945032E 02
BODY 5	0.77396145E 02	0.80000000E 02	0.70323672E 02
BODY 6	0.68570400E 02	0.80000000E 02	0.57005838E 02
	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.15596165E 02	0.71837343E 01	0.27061283E 04
BODY 2	0.10170813E 02	0.46598076E 01	0.26810837E 04
BODY 3	0.97013588E 01	0.34083234E 01	0.26590486E 04
BODY 4	0.73347623E 01	0.25488857E 01	0.26417110E 04
BODY 5	0.70724735E 01	0.17532715E 01	0.26257237E 04
BODY 6	0.11564562E 02	0.25058434E 01	0.26016795E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.41322596E 03	0.51569771E 03	0.58025488E 03
BODY	2	0.34502727E 03	0.41322596E 03	0.48321212E 03
BODY	3	0.30055106E 03	0.34502727E 03	0.42048204E 03
BODY	4	0.24235638E 03	0.30055106E 03	0.36528171E 03
BODY	5	0.31258581E 03	0.26457793E 03	0.32377753E 03
BODY	6	0.31258581E 03	0.20118429E 03	0.28679284E 03

NLORD ARRAY = 3

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.24807693E 05	0.11023534E 04
		MASS FRACTION	HPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 02

NCORD ARRAY = 2 3

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.12449562E 05	0.38971139E 03
CONDENSATE FLASH TANK	2	0.12040985E 05	0.40857720E 03

```
FINAL PRODUCT FLOW RATE =            24807.69 KGS/HR
TOTAL EVAPORATION IN THE PLANT =     61192.31 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     12839.27 KGS/HR
STEAM ECONOMY =             4.7660 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

```
NUMBER OF EFFECTS  6                NUMBER OF BODIES  7
FLOW ORDER    7   6   5   4   3   2   1
IFEED ARRAY   2   3   4   5  10   8   8
DESIGN =  1.00                      FCHEAT =  1.00
STEAM TEMP. =  138.00               FEED TEMP. =   80.00
CONDENSATE TEMP. =   54.50          RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO   1 =   0.8000
AREA RATIO   2 =   0.5000
NAA          1 =   4
NAA          2 =   2
LIQUOR FLASH TANK  1                CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0                  FINISHER EFFECT  0
IBLEED  0                           KALBPR  1
TOTAL FEED FLOW RATE =           86000.00
MASS FRACTION FEED = 0.150          MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2           IFSORD ARRAY  7  6
FEED STREAM  1                         34400.00
FEED STREAM  2                         51600.00
MULTIPLE FEED STREAM TO BODY  1            0.00
MULTIPLE FEED STREAM TO BODY  2            0.00
MULTIPLE FEED STREAM TO BODY  3            0.00
MULTIPLE FEED STREAM TO BODY  4            0.00
MULTIPLE FEED STREAM TO BODY  5            0.00
MULTIPLE FEED STREAM TO BODY  6            0.00
MULTIPLE FEED STREAM TO BODY  7            0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.79500000E 00	0.26150633E 03	0.31078048E 04
BODY	2	0.10200000E 01	0.26150130E 03	0.43594908E 04
BODY	3	0.12500000E 01	0.52302522E 03	0.67643648E 04
BODY	4	0.13600000E 01	0.52303782E 03	0.70030462E 04
BODY	5	0.13550000E 01	0.65377349E 03	0.65899095E 04
BODY	6	0.12500000E 01	0.65377235E 03	0.58546705E 04
BODY	7	0.90000000E 00	0.65377708E 03	0.68886345E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.49082189E 04	0.25928583E 05	0.49752045E 00
BODY	2	0.55820712E 04	0.30836597E 05	0.41833409E 00
BODY	3	0.93491890E 04	0.36418464E 05	0.35421593E 00
BODY	4	0.98171926E 04	0.45767419E 05	0.28185990E 00
BODY	5	0.85239602E 04	0.55584704E 05	0.23207823E 00
BODY	6	0.99637328E 04	0.41636067E 05	0.18589652E 00
BODY	7	0.11927186E 05	0.22472810E 05	0.22961080E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13800000E 03	0.12165587E 03	0.12305127E 03
BODY	2	0.13800000E 03	0.10552732E 03	0.12165587E 03
BODY	3	0.11587384E 03	0.91020498E 02	0.10552732E 03
BODY	4	0.10086548E 03	0.80175176E 02	0.91020498E 02
BODY	5	0.87614148E 02	0.66573763E 02	0.80175176E 02
BODY	6	0.77628240E 02	0.80000000E 02	0.70464069E 02
BODY	7	0.68711827E 02	0.80000000E 02	0.57004414E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14948733E 02	0.71774253E 01	0.27378725E 04
BODY	2	0.16344127E 02	0.57820317E 01	0.27056210E 04
BODY	3	0.10346522E 02	0.46618366E 01	0.26818218E 04
BODY	4	0.98449834E 01	0.34063490E 01	0.26595912E 04
BODY	5	0.74389707E 01	0.25469361E 01	0.26421019E 04
BODY	6	0.71641702E 01	0.17522419E 01	0.26259685E 04
BODY	7	0.11707413E 02	0.25044188E 01	0.26016780E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.51034112E 03	0.52016742E 03	0.58025488E 03
BODY	2	0.41588754E 03	0.51034112E 03	0.58025488E 03
BODY	3	0.34668394E 03	0.41588754E 03	0.48598392E 03
BODY	4	0.30162331E 03	0.34668394E 03	0.42249163E 03
BODY	5	0.24276102E 03	0.30162331E 03	0.36668655E 03
BODY	6	0.31258581E 03	0.26519787E 03	0.32475102E 03
BODY	7	0.31258581E 03	0.20119160E 03	0.28738502E 03

NLORD ARRAY =   4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.24807887E 05	0.11207557E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.12480045E 05	0.40942733E 03
CONDENSATE FLASH TANK	2	0.12099207E 05	0.38083774E 03

```
FINAL PRODUCT FLOW RATE =           24807.69 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    61192.31 KGS/HR
STEAM REQUIRED IN BODY(1) =          5364.39 KGS/HR
STEAM REQUIRED IN BODY(2) =          7525.08 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    12889.47 KGS/HR
STEAM ECONOMY =            4.7475 KGS VAPOR/KG STEAM
NUMBER OF ITERATICNS =   6
```

PLANT NO. 24

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER   7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN = 1.00                           FCHEAT = 1.00
STEAM TEMP. =  144.50                   FEED TEMP. =   75.00
CONDENSATE TEMP. =   46.10              RADIATION LOSS FRACTION= 0.035
AREA RATIO OF BODY(1) TO BODY(2) = 0.323
AREA RATIO  1 =  0.7890
AREA RATIO  2 =  0.7540
NAA         1 =  3
NAA         2 =  2
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  1
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =        162500.00
MASS FRACTION FEED = 0.165              MASS FRACTION PRODUCT = 0.545
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                             81250.00
FEED STREAM  2                             81250.00
MULTIPLE FEED STREAM TO BODY  1             0.00
MULTIPLE FEED STREAM TO BODY  2             0.00
MULTIPLE FEED STREAM TO BODY  3             0.00
MULTIPLE FEED STREAM TO BODY  4             0.00
MULTIPLE FEED STREAM TO BODY  5             0.00
MULTIPLE FEED STREAM TO BODY  6             0.00
MULTIPLE FEED STREAM TO BODY  7             0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.12150000E 01	0.15751569E 03	0.31383201E 04
BODY	2	0.14090000E 01	0.48773459E 03	0.11814178E 05
BODY	3	0.14590000E 01	0.64682212E 03	0.13070690E 05
BODY	4	0.16650000E 01	0.81982129E 03	0.13529455E 05
BODY	5	0.14760000E 01	0.81982046E 03	0.12301490E 05
BODY	6	0.11980000E 01	0.81981967E 03	0.10179973E 05
BODY	7	0.10550000E 01	0.81981910E 03	0.12290360E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.49695205E 04	0.52111037E 05	0.51452631E 00
BODY	2	0.15389491E 05	0.57081420E 05	0.46972377E 00
BODY	3	0.17911648E 05	0.72471772E 05	0.36997163E 00
BODY	4	0.18276163E 05	0.90383361E 05	0.29665305E 00
BODY	5	0.14359197E 05	0.10865946E 06	0.24675716E 00
BODY	6	0.17136456E 05	0.64113570E 05	0.20910159E 00
BODY	7	0.22344979E 05	0.58905049E 05	0.22759084E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.14450000E 03	0.12730869E 03	0.12810176E 03
BODY	2	0.14450000E 03	0.10677245E 03	0.12730869E 03
BODY	3	0.12062273E 03	0.91924401E 02	0.10677245E 03
BODY	4	0.10183607E 03	0.78095967E 02	0.91924401E 02
BODY	5	0.88262027E 02	0.57410997E 02	0.78095967E 02
BODY	6	0.75295943E 02	0.75000000E 02	0.64930891E 02
BODY	7	0.62779614E 02	0.75000000E 02	0.48569612E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.16398236E 02	0.74790359E 01	0.27465160E 04
BODY	2	0.17191310E 02	0.66859619E 01	0.27134608E 04
BODY	3	0.13850273E 02	0.49363798E 01	0.26836068E 04
BODY	4	0.99116709E 01	0.36623745E 01	0.26609123E 04
BODY	5	0.10166059E 02	0.28000231E 01	0.26384042E 04
BODY	6	0.10365052E 02	0.21512774E 01	0.26160035E 04
BODY	7	0.14210001E 02	0.24696171E 01	0.25865665E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.54908407E 03	0.55634248E 03	0.60815468E 03
BODY	2	0.42182267E 03	0.54908407E 03	0.60815468E 03
BODY	3	0.34943517E 03	0.42182267E 03	0.50613908E 03
BODY	4	0.28997326E 03	0.34943517E 03	0.42658994E 03
BODY	5	0.20410184E 03	0.28997326E 03	0.36941103E 03
BODY	6	0.28825176E 03	0.23769288E 03	0.31497068E 03
BODY	7	0.28825176E 03	0.16754061E 03	0.26255716E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.49195759E 05	0.29152960E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.54500000E 00	0.80213748E 01

NCORD ARRAY = 3

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.25296757E 05	0.88402487E 03

FINAL PRODUCT FLOW RATE =   49197.25 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   113302.75 KGS/HR
STEAM REQUIRED IN BODY(1) =   5495.60 KGS/HR
STEAM REQUIRED IN BODY(2) =   20685.18 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   26180.78 KGS/HR
STEAM ECONOMY =   4.3277 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 14

PLANT NO. 25

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN = 1.00                           FCHEAT = 1.00
STEAM TEMP. = 138.50                    FEED TEMP. =    88.00
CONDENSATE TEMP. =   54.50              RADIATION LOSS FRACTION= 0.030
AREA RATIC CF BODY(1) TO BCDY(2) = 1.000
AREA RATIO  1 =  0.5000
NAA         1 =  2
LIQUOR FLASH TANK  2                    CONDENSATE FLASH TANK  2
INTEGRAL HEATER  5                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLCW RATE =       226800.00
MASS FRACTICN FEED = 0.150              MASS FRACTION PRODUCT = 0.540
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                             113400.00
FEED STREAM  2                             113400.00
MULTIPLE FEED STREAM TO BODY  1               0.00
MULTIPLE FEED STREAM TO BODY  2               0.00
MULTIPLE FEED STREAM TO BODY  3               0.00
MULTIPLE FEED STREAM TC BODY  4               0.00
MULTIPLE FEED STREAM TC BODY  5               0.00
MULTIPLE FEED STREAM TC BODY  6               0.00
MULTIPLE FEED STREAM TC BCDY  7               0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.11300000E 01	0.63814095E 03	0.76701790E 04
BODY	2	0.13600000E 01	0.63814747E 03	0.10390336E 05
BODY	3	0.14750000E 01	0.12764043E 04	0.16929745E 05
BODY	4	0.13550000E 01	0.12763238E 04	0.16810547E 05
BODY	5	0.13500000E 01	0.12762979E 04	0.17782959E 05
BODY	6	0.14700000E 01	0.12763619E 04	0.16590267E 05
BODY	7	0.11400000E 01	0.12763761E 04	0.19118098E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.12208032E 05	0.68193512E 05	0.49887443E 00
BODY	2	0.14540780E 05	0.80401143E 05	0.42312832E 00
BODY	3	0.23450706E 05	0.94941521E 05	0.35832584E 00
BODY	4	0.22740879E 05	0.11839297E 06	0.28734815E 00
BODY	5	0.23947942E 05	0.14113467E 06	0.24104638E 00
BODY	6	0.27438600E 05	0.85961857E 05	0.19787846E 00
BODY	7	0.34279921E 05	0.79120489E 05	0.21498856E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13850000E 03	0.12652792E 03	0.12786321E 03
BODY	2	0.13850000E 03	0.11912173E 03	0.12652792E 03
BODY	3	0.12066180E 03	0.10404848E 03	0.11166951E 03
BODY	4	0.10693610E 03	0.89945167E 02	0.97215759E 02
BODY	5	0.93714461E 02	0.76537015E 02	0.83393546E 02
BODY	6	0.80692016E 02	0.88000000E 02	0.71849778E 02
BODY	7	0.69891559E 02	0.88000000E 02	0.56752593E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.10636786E 02	0.72014127E 01	0.27385509E 04
BODY	2	0.11972081E 02	0.58661181E 01	0.27126589E 04
BODY	3	0.89922865E 01	0.47334089E 01	0.26911901E 04
BODY	4	0.97203448E 01	0.35012977E 01	0.26694811E C4
BODY	5	0.10320915E 02	0.27015299E 01	0.26474213E 04
BODY	6	0.88422378E 01	0.19582178E 01	0.26282312E 04
BODY	7	0.13138965E 02	0.22525964E 01	0.26014144E C4
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.54229347E 03	0.55403134E 03	0.58239724E 03
BODY	2	0.48071675E 03	0.54229347E 03	0.58239724E 03
BODY	3	0.40377171E 03	0.45064325E 03	0.50630507E 03
BODY	4	0.34004491E 03	0.37725659E 03	0.44814049E 03
BODY	5	0.28696834E 03	0.31527598E 03	0.39235984E 03
BODY	6	0.34860639E 03	0.26939398E 03	0.33760642E 03
BODY	7	0.34860639E 03	0.20248368E 03	0.29232532E 03

IPRCCH =   0
IIH ARRAY =   0   0   1   1   1   1   1

SPECIFIED AREA RATIO = 0.080

			H T COEFF	AREA
INTEGRAL HEATER 1	IN BODY	3	0.14750000E 01	0.10211234E 03
INTEGRAL HEATER 2	IN BODY	4	0.13550000E 01	0.10210590E 03
INTEGRAL HEATER 3	IN BODY	5	0.13500000E 01	0.10210383E 03
INTEGRAL HEATER 4	IN BODY	6	0.14700000E 01	0.10210895E 03
INTEGRAL HEATER 5	IN BODY	7	0.11400000E 01	0.10211009E 03
			TEMP TIHIN	TEMP TIHOUT
INTEGRAL HEATER 1	IN BODY	3	0.11166951E 03	0.11912173E 03
INTEGRAL HEATER 2	IN BODY	4	0.97215759E 02	0.10404848E 03
INTEGRAL HEATER 3	IN BODY	5	0.83393546E 02	0.89945167E 02
INTEGRAL HEATER 4	IN BODY	6	0.70099864E 02	0.76537015E 02
INTEGRAL HEATER 5	IN BODY	7	0.56752593E 02	0.67947645E 02
			TEMP DIFF	H T RATE
INTEGRAL HEATER 1	IN BODY	3	0.74522209E 01	0.79311771E 03
INTEGRAL HEATER 2	IN BODY	4	0.68327198E 01	0.87200139E 03
INTEGRAL HEATER 3	IN BODY	5	0.65516205E 01	0.97104280E 03
INTEGRAL HEATER 4	IN BODY	6	0.64371510E 01	0.11067621E 04
INTEGRAL HEATER 5	IN BODY	7	0.11195052E 02	0.87784311E 03

```
NLORD ARRAY =  4  5
                                        PRODUCT              VAPOR FLOW
LIQUOR FLASH TANK   1            0.65380272E 05        0.28131849E 04
LIQUOR FLASH TANK   2            0.63000187E 05        0.23799481E 04
                                     MASS FRACTION             BPRLFT
LIQUOR FLASH TANK   1            0.52034044E 00        0.75823220E 01
LIQUOR FLASH TANK   2            0.54000000E 00        0.79322211E 01

NCORD ARRAY =  3  5
                                        PRODUCT              VAPOR FLOW
CONDENSATE FLASH TANK   1        0.30464841E 05        0.73136439E 03
CONDENSATE FLASH TANK   2        0.28793184E 05        0.16716575E 04


FINAL PRODUCT FLOW RATE =            63000.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   163800.00 KGS/HR
STEAM REQUIRED IN BODY(1) =         13248.90 KGS/HR
STEAM REQUIRED IN BODY(2) =         17947.31 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    31196.21 KGS/HR
STEAM ECONOMY =              5.2506 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  7
```

PLANT NO. 26

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN =  1.00                          FCHEAT =  1.00
STEAM TEMP. =  138.50                   FEED TEMP. =   88.00
CONDENSATE TEMP. =   54.50              RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =  0.5000
NAA          1 =  2
LIQUOR FLASH TANK  2                    CONDENSATE FLASH TANK   2
INTEGRAL HEATER  5                      FINISHER EFFECT   0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =        226800.00
MASS FRACTION FEED = 0.150              MASS FRACTION PRODUCT = 0.540
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                             113400.00
FEED STREAM  2                             113400.00
MULTIPLE FEED STREAM TO BODY  1               0.00
MULTIPLE FEED STREAM TO BODY  2               0.00
MULTIPLE FEED STREAM TO BODY  3               0.00
MULTIPLE FEED STREAM TO BODY  4               0.00
MULTIPLE FEED STREAM TO BODY  5               0.00
MULTIPLE FEED STREAM TO BODY  6               0.00
MULTIPLE FEED STREAM TO BODY  7               0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.11300000E 01	0.63795659E 03	0.76308925E 04
BODY	2	0.13600000E 01	0.63791394E 03	0.10337092E 05
BODY	3	0.14750000E 01	0.12759579E 04	0.16809504E 05
BODY	4	0.13550000E 01	0.12759894E 04	0.16832503E 05
BODY	5	0.13500000E 01	0.12760407E 04	0.17925619E 05
BODY	6	0.14700000E 01	0.12760395E 04	0.16809769E 05
BODY	7	0.11400000E 01	0.12760104E 04	0.18959672E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.12146444E 05	0.68190080E 05	0.49889955E 00
BODY	2	0.14416171E 05	0.80336090E 05	0.42347095E 00
BODY	3	0.23504863E 05	0.94751827E 05	0.35904321E 00
BODY	4	0.22974516E 05	0.11825698E 06	0.28767858E 00
BODY	5	0.24275983E 05	0.14123196E 06	0.24088032E 00
BODY	6	0.27163039E 05	0.86236793E 05	0.19724759E 00
BODY	7	0.34128786E 05	0.79271078E 05	0.21458015E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13850000E 03	0.12658491E 03	0.12791464E 03
BODY	2	0.13850000E 03	0.11892647E 03	0.12658491E 03
BODY	3	0.12071278E 03	0.10508821E 03	0.11178123E 03
BODY	4	0.10703533E 03	0.91711558E 02	0.97299737E 02
BODY	5	0.93792721E 02	0.78485386E 02	0.83386911E 02
BODY	6	0.80688244E 02	0.88000000E 02	0.71726752E 02
BODY	7	0.69779383E 02	0.88000000E 02	0.56745562E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.10585363E 02	0.72018577E 01	0.27385513E 04
BODY	2	0.11915092E 02	0.58721294E 01	0.27127384E 04
BODY	3	0.89315435E 01	0.47459046E 01	0.26913535E 04
BODY	4	0.97355916E 01	0.35070156E 01	0.26696109E 04
BODY	5	0.10405810E 02	0.26986665E 01	0.26474120E 04
BODY	6	0.89614911E 01	0.19473695E 01	0.26280254E 04
BODY	7	0.13033821E 02	0.22455662E 01	0.26014070E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.54268257E 03	0.55439952E 03	0.58239724E 03
BODY	2	0.48010433E 03	0.54268257E 03	0.58239724E 03
BODY	3	0.40788291E 03	0.45125913E 03	0.50652163E 03
BODY	4	0.34674141E 03	0.37765321E 03	0.44856006E 03
BODY	5	0.29429469E 03	0.31526773E 03	0.39268950E 03
BODY	6	0.34860639E 03	0.26895201E 03	0.33759059E 03
BODY	7	0.34860639E 03	0.20251977E 03	0.29185553E 03

```
IPRCCH =   1                        SPECIFIED TEMP. DIFF. RATIO= 0.800
IIH ARRAY =  0  0  1  1  1  1  1
```

			H T COEFF	AREA
INTEGRAL HEATER 1	IN BODY	3	0.14750000E 01	0.96048119E 02
INTEGRAL HEATER 2	IN BODY	4	0.13550000E 01	0.12545998E 03
INTEGRAL HEATER 3	IN BODY	5	0.13500000E 01	0.14649306E 03
INTEGRAL HEATER 4	IN BODY	6	0.14700000E 01	0.15636197E 03
INTEGRAL HEATER 5	IN BODY	7	0.11400000E 01	0.91913991E 02
			TEMP TIHIN	TEMP TIHOUT
INTEGRAL HEATER 1	IN BODY	3	0.11178123E 03	0.11892647E 03
INTEGRAL HEATER 2	IN BODY	4	0.97299737E 02	0.10508821E 03
INTEGRAL HEATER 3	IN BODY	5	0.83386911E 02	0.91711558E 02
INTEGRAL HEATER 4	IN BODY	6	0.69673956E 02	0.78485386E 02
INTEGRAL HEATER 5	IN BODY	7	0.56745562E 02	0.67172618E 02
			TEMP DIFF	H T RATE
INTEGRAL HEATER 1	IN BODY	3	0.71452351E 01	0.75920437E 03
INTEGRAL HEATER 2	IN BODY	4	0.77884731E 01	0.99302030E 03
INTEGRAL HEATER 3	IN BODY	5	0.83246479E 01	0.12347470E 04
INTEGRAL HEATER 4	IN BODY	6	0.88114300E 01	0.15189944E 04
INTEGRAL HEATER 5	IN BODY	7	0.10427056E 02	0.81942555E 03

```
NLORD ARRAY =  4  5
                                    PRODUCT              VAPOR FLOW
LIQUOR FLASH TANK  1          0.65385617E 05       0.28047824E 04
LIQUOR FLASH TANK  2          0.63000860E 05       0.23854117E 04
                                  MASS FRACTION          BPRLFT
LIQUOR FLASH TANK  1          0.52029791E 00       0.75815661E 01
LIQUOR FLASH TANK  2          0.54000000E 00       0.79322211E 01

NCORD ARRAY =  3  5
                                    PRODUCT              VAPOR FLOW
CONDENSATE FLASH TANK  1      0.30312335E 05       0.72422229E 03
CONDENSATE FLASH TANK  2      0.28650373E 05       0.16619613E 04


FINAL PRODUCT FLOW RATE =             63000.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =     163800.00 KGS/HR
STEAM REQUIRED IN BODY(1) =           13180.53 KGS/HR
STEAM REQUIRED IN BODY(2) =           17856.03 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =      31036.56 KGS/HR
STEAM ECONOMY =               5.2776 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 27

```
NUMBER OF EFFECTS   6                        NUMBER OF BODIES   7
FLOW ORDER     7   6   5   4   3   2   1
IFEED ARRAY    2   3   4   5  10   8   8
DESIGN =   1.00                              FCHEAT =  1.00
STEAM TEMP. =  138.50                        FEED TEMP. =     88.00
CONDENSATE TEMP. =      54.50                RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO   1 =   0.9000
AREA RATIO   2 =   0.5000
NAA          1 =   3
NAA          2 =   2
LIQUOR FLASH TANK   2                        CONDENSATE FLASH TANK   2
INTEGRAL HEATER   5                          FINISHER EFFECT   0
IBLEED   0                                   KALBPR   1
TOTAL FEED FLOW RATE =       226800.00
MASS FRACTION FEED = 0.150                   MASS FRACTION PRODUCT = 0.540
NUMBER OF FEED STREAMS   2                   IFSORD ARRAY   7   6
FEED STREAM   1                                 113400.00
FEED STREAM   2                                 113400.00
MULTIPLE FEED STREAM TO BODY   1                     0.00
MULTIPLE FEED STREAM TO BODY   2                     0.00
MULTIPLE FEED STREAM TO BODY   3                     0.00
MULTIPLE FEED STREAM TO BODY   4                     0.00
MULTIPLE FEED STREAM TO BODY   5                     0.00
MULTIPLE FEED STREAM TO BODY   6                     0.00
MULTIPLE FEED STREAM TO BODY   7                     0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.11300000E 01	0.59451790E 03	0.76252412E 04
BODY	2	0.13600000E 01	0.59449648E 03	0.10249678E 05
BODY	3	0.14750000E 01	0.11890953E 04	0.16709274E 05
BODY	4	0.13550000E 01	0.13212463E 04	0.16806594E 05
BODY	5	0.13500000E 01	0.13212949E 04	0.17900650E 05
BODY	6	0.14700000E 01	0.13212956E 04	0.16821485E 05
BODY	7	0.11400000E 01	0.13212696E 04	0.19034992E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.12121613E 05	0.68207733E 05	0.49877042E 00
BODY	2	0.14203984E 05	0.80329024E 05	0.42350819E 00
BODY	3	0.23292289E 05	0.94532686E 05	0.35987553E 00
BODY	4	0.23025501E 05	0.11782528E 06	0.28873260E 00
BODY	5	0.24336957E 05	0.14085118E 06	0.24153152E 00
BODY	6	0.27328769E 05	0.86071142E 05	0.19762721E 00
BODY	7	0.34283016E 05	0.79116914E 05	0.21499827E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13850000E 03	0.12582284E 03	0.12714963E 03
BODY	2	0.13850000E 03	0.11804468E 03	0.12582284E 03
BODY	3	0.11995005E 03	0.10378528E 03	0.11042321E 03
BODY	4	0.10566281E 03	0.90742824E 02	0.96275163E 02
BODY	5	0.92749908E 02	0.77868232E 02	0.82714494E 02
BODY	6	0.80004597E 02	0.88000000E 02	0.71344016E 02
BODY	7	0.69390119E 02	0.88000000E 02	0.56752758E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.11350375E 02	0.71995699E 01	0.27385489E 04
BODY	2	0.12677162E 02	0.58727828E 01	0.27116419E 04
BODY	3	0.95268404E 01	0.47604038E 01	0.26892839E 04
BODY	4	0.93876439E 01	0.35252559E 01	0.26679774E 04
BODY	5	0.10035413E 02	0.27098955E 01	0.26462777E 04
BODY	6	0.86605809E 01	0.19538974E 01	0.26273573E 04
BODY	7	0.12637361E 02	0.22527637E 01	0.26014145E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.53762608E 03	0.54894387E 03	0.58239724E 03
BODY	2	0.47395517E 03	0.53762608E 03	0.58239724E 03
BODY	3	0.40135055E 03	0.44335458E 03	0.50328186E 03
BODY	4	0.34232575E 03	0.37230800E 03	0.44275746E 03
BODY	5	0.29165354E 03	0.31203901E 03	0.38829742E 03
BODY	6	0.34860639E 03	0.26721726E 03	0.33472127E 03
BODY	7	0.34860639E 03	0.20248281E 03	0.29022534E 03

IPRCCH = 1

SPECIFIED TEMP. DIFF. RATIO= 0.800

IIH ARRAY = 0 0 1 1 1 1 1

			H T COEFF	AREA
INTEGRAL HEATER 1	IN BODY	3	0.14750000E 01	0.95305277E 02
INTEGRAL HEATER 2	IN BODY	4	0.13550000E 01	0.12454419E 03
INTEGRAL HEATER 3	IN BODY	5	0.13500000E 01	0.14577739E 03
INTEGRAL HEATER 4	IN BODY	6	0.14700000E 01	0.15588503E 03
INTEGRAL HEATER 5	IN BODY	7	0.11400000E 01	0.91706874E 02
			TEMP TIHIN	TEMP TIHOUT
INTEGRAL HEATER 1	IN BODY	3	0.11042321E 03	0.11804468E 03
INTEGRAL HEATER 2	IN BODY	4	0.96275163E 02	0.10378528E 03
INTEGRAL HEATER 3	IN BODY	5	0.82714494E 02	0.90742824E 02
INTEGRAL HEATER 4	IN BODY	6	0.69322772E 02	0.77868232E 02
INTEGRAL HEATER 5	IN BODY	7	0.56752758E 02	0.66862646E 02
			TEMP DIFF	H T RATE
INTEGRAL HEATER 1	IN BODY	3	0.76214723E 01	0.80354314E 03
INTEGRAL HEATER 2	IN BODY	4	0.75101157E 01	0.95054068E 03
INTEGRAL HEATER 3	IN BODY	5	0.80283308E 01	0.11849786E 04
INTEGRAL HEATER 4	IN BODY	6	0.85454597E 01	0.14686507E 04
INTEGRAL HEATER 5	IN BODY	7	0.10109888E 02	0.79271013E 03

```
NLORD ARRAY =  4   5
                                  PRODUCT              VAPOR FLOW
LIQUOR FLASH TANK   1 .         0.65301904E 05       0.29061303E 04
LIQUOR FLASH TANK   2  •        0.63000737E 05       0.23017357E 04
                                MASS FRACTION          BPRLFT
LIQUOR FLASH TANK   1          0.52096490E 00       0.75934204E 01
LIQUOR FLASH TANK   2          0.540C0000E 00       0.79322211E 01

NCCRD ARRAY =  3   5
                                  PRODUCT              VAPOR FLOW
CONDENSATE FLASH TANK   1       0.30110078E 05       0.76565103E 03
CONDENSATE FLASH TANK   2       0.28446874E 05       0.1663203SE 04


FINAL PRODUCT FLOW RATE =            63000.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    163800.00 KGS/HR
STEAM REQUIRED IN BODY(1) =          13170.97 KGS/HR
STEAM REQUIRED IN BODY(2) =          17704.76 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     30875.73 KGS/HR
STEAM ECONOMY =             5.3051 KGS VAPOR/KG STEAM
NUMBER OF ITERATICNS =  6
```

PLANT NO. 28

```
NUMBER CF EFFECTS  5                    NUMBER OF BODIES  6
FLOW ORDER    5  6  4  2  1  3
IFEED ARRAY   2  4  1  6  7  5
DESIGN = 1.00                           FCHEAT = 1.00
STEAM TEMP. = 145.00                    FEED TEMP. =    71.20
CONDENSATE TEMP. =    54.50             RADIATION LOSS FRACTION= 0.040
AREA RATIO CF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =  0.5000
NAA         1 =  2
LIQUOR FLASH TANK  1                    CCNCENSATE FLASH TANK  2
INTEGRAL HEATER  3                      FINISHER EFFECT  C
IBLEED  0                               KALBPR  0
TOTAL FEED FLOW RATE =        69000.00
MASS FRACTION FEED = 0.150              MASS FRACTICN PRODUCT = 0.500
NUMBER CF FEED STREAMS  1               IFSCRD ARRAY  5
FEED STREAM  1                          35000.00
MULTIPLE FEED STREAM TO BODY  1          0.00
MULTIPLE FEED STREAM TO BODY  2          0.00
MULTIPLE FEED STREAM TO BODY  3          0.00
MULTIPLE FEED STREAM TO BODY  4          0.00
MULTIPLE FEED STREAM TO BODY  5          0.00
MULTIPLE FEED STREAM TO BODY  6         34000.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.11900000E 01	0.17324752E 03	0.32395842E 04
BODY	2	0.11900000E 01	0.17327271E 03	0.34462497E 04
BODY	3	0.10800000E 01	0.34664112E 03	0.58215726E 04
BODY	4	0.14750000E 01	0.34658791E 03	0.67443481E 04
BODY	5	0.17000000E 01	0.34660021E 03	0.64647453E 04
BODY	6	0.10800000E 01	0.34659303E 03	0.63859153E 04

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.51980668E 04	0.30655104E 05	0.33762730E 00
BODY	2	0.39093065E 04	0.35852383E 05	0.28868374E 00
BODY	3	0.10013446E 05	0.20641325E 05	0.50142130E 00
BODY	4	0.95494957E 04	0.39760902E 05	0.26030597E 00
BODY	5	0.91979363E 04	0.25801482E 05	0.20347668E 00
BODY	6	0.10490646E 05	0.49310488E 05	0.20989449E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.14500000E 03	0.12828641E 03	0.12928641E 03
BODY	2	0.14500000E 03	0.11773761E 03	0.12828641E 03
BODY	3	0.12478641E 03	0.12928641E 03	0.10923513E 03
BODY	4	0.10273513E 03	0.83265232E 02	0.89542399E 02
BODY	5	0.86542399E 02	0.71200000E 02	0.75570706E 02
BODY	6	0.73570705E 02	0.75570706E 02	0.56499998E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.15713585E 02	0.45000000E 01	0.27440233E 04
BODY	2	0.16713585E 02	0.35000000E 01	0.27160504E 04
BODY	3	0.15551287E 02	0.65000000E 01	0.26866267E 04
BODY	4	0.13192726E 02	0.30000000E 01	0.26574172E 04
BODY	5	0.10971694E 02	0.20000000E 01	0.26346166E 04
BODY	6	0.17070708E 02	0.20000000E 01	0.26011500E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.54868259E 03	0.55685558E 03	C.61030538E C3
BODY	2	0.44976224E 03	0.54868259E 03	C.61030538E C3
BODY	3	0.55685558E 03	0.42849624E 03	C.52384230E C3
BODY	4	0.29806862E 03	0.34205544E 03	C.43038699E C3
BODY	5	0.27396320E 03	0.28499382E 03	C.36218067E C3
BODY	6	0.28499382E 03	0.20225580E 03	C.30773906E C3

IPRCCH = 1   SPECIFIEC TEMP. CIFF. RATIC= C.8CO

IIH ARRAY = C 0 1 0 1 1

				H T COEFF	AREA
INTEGRAL HEATER	1	IN	BCCY	3	0.108CCCCCE 01	0.27767368E C2
INTEGRAL HEATER	2	IN	BCCY	5	0.17CCCCCCE 01	0.21199892E C2
INTEGRAL HEATER	3	IN	BCCY	6	0.108CCCCCE 01	0.60534689E C2
				TEMP TIHIN	TEMP TIHCUT
INTEGRAL HEATER	1	IN	BCCY	3	0.89542399E C2	0.11773761E C3
INTEGRAL HEATER	2	IN	BCCY	5	0.70156564E C2	0.83265232E C2
INTEGRAL HEATER	3	IN	BCCY	6	0.56499998E C2	0.70156564E C2
				TEMP CIFF	H T RATE
INTEGRAL HEATER	1	IN	BCCY	3	0.28199211E 02	C.63415453E C3
INTEGRAL HEATER	2	IN	BCCY	5	0.13108668E 02	C.35430941E C3
INTEGRAL HEATER	3	IN	BCCY	6	0.13656566E 02	0.66962376E C3

NLCRD ARRAY = 4

			PRCCUCT	VAPCR FLOW
LICLCR FLASH TANK	1		0.2C7C0146E 05	−0.58895246E C2
			MASS FRACTION	BPRLFT
LIQLCR FLASH TANK	1		0.5C0000CCE 0C	0.75CCCC0CE 01

NCCRD ARRAY = 3 4

		PRCCUCT	VAPCR FLCW
CONCENSATE FLASH TANK	1	0.11389269E 05	0.38702523E C3
CONCENSATE FLASH TANK	2	0.1097594CE 05	C.41332845E C3

FINAL PRCDLCT FLCW RATE =   207CC.CO KGS/HR
TOTAL EVAPCRATICN IN THE PLANT =   48300.CO KGS/HR
STEAM RECUIREC IN BCCY(1) =   5706.57 KGS/HR
STEAM RECUIREC IN BCCY(2) =   6069.73 KGS/HR
TCTAL STEAM RECUIREC IN BCCIES =   11776.29 KGS/HR
STEAM ECCNCMY =   4.1015 KGS VAPCR/KG STEAM
NUMBER CF ITERATICNS =   6

PLANT NO. 29

NUMBER OF EFFECTS 5   NUMBER OF BODIES 6
FLOW ORDER   5 6 4 2 1 3
IFEED ARRAY 2 4 1 6 7 5
DESIGN = 1.00   FCHEAT = 1.0
STEAM TEMP. = 145.0   FEED TEMP. = 71.20
CONDENSATE TEMP. =   54.50   RADIATION LOSS FRACTION= 0.04
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO 1 = 0.5 0
NAA   1 = 2
LIQUOR FLASH TANK 1   CONDENSATE FLASH TANK 2
INTEGRAL HEATER 3   FINISHER EFFECT 5
IPLEED 7   KALBPR 0
TOTAL FEED FLOW RATE =   69000.00
MASS FRACTION FEED = 0.150   MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS 1   IFSORD ARRAY 5
FEED STREAM 1   35000.00
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00
MULTIPLE FEED STREAM TO BODY 4   0.00
MULTIPLE FEED STREAM TO BODY 5   0.00
MULTIPLE FEED STREAM TO BODY 6   34000.00

		H T COEFF	AREA	H T RATE
BODY	1	0.11900000E 01	0.17036892E 03	0.31059683E 04
BODY	2	0.11900000E 01	0.17039135E 03	0.33091429E 04
BODY	3	0.10800000E 01	0.34087109E 03	0.55513693E 04
BODY	4	0.14750000E 01	0.34081499E 03	0.64469390E 04
BODY	5	0.17000000E 01	0.34083691E 03	0.66551547E 04
BODY	6	0.10800000E 01	0.34083124E 03	0.65484902E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.49828820E 04	0.31083113E 05	0.33297824E 00
BODY	2	0.37129399E 04	0.36065272E 05	0.28697968E 00
BODY	3	0.95419843E 04	0.21540587E 05	0.48048831E 00
BODY	4	0.90578550E 04	0.39777489E 05	0.26019742E 00
BODY	5	0.94358307E 04	0.25563611E 05	0.20537004E 00
BODY	6	0.10727614E 05	0.48835802E 05	0.21193468E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.14500000E 03	0.12867997E 03	0.12967997E 03
BODY	2	0.14500000E 03	0.11829916E 03	0.12867997E 03
BODY	3	0.12517997E 03	0.12967997E 03	0.11010049E 03
BODY	4	0.10360049E 03	0.84367149E 02	0.90775920E 02
BODY	5	0.87775920E 02	0.71200000E 02	0.76290083E 02
BODY	6	0.74290083E 02	0.76290083E 02	0.56459997E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.15320032E 02	0.45000000E 01	0.27440233E 04
BODY	2	0.16320033E 02	0.35000000E 01	0.27166042E 04
BODY	3	0.15079474E 02	0.65000000E 01	0.26879546E 04
BODY	4	0.12824571E 02	0.30000000E 01	0.26594291E 04
BODY	5	0.11485836E 02	0.20000000E 01	0.26358487E 04
BODY	6	0.17790086E 02	0.20000000E 01	0.26011500E 04

```
                    ENTHALPY LIN          ENTHALPY LOUT            ENTHALPY C
BODY   1            0.55094233E 03        0.55908901E 03          0.62 315381  05
BODY   2            0.45361230E 03        0.55094233E 03          1.61 31635   03
BODY   3            0.55908901E 03        0.43510244E 03          0.52551726  03
BODY   4            0.40152864E 03        0.34807580E 03          0.45404252  05
BODY   5            0.27396320E 03        0.28792360E 03          0.36735680  05
BODY   6            0.28792360E 03        0.20193129E 03          0.31 75415   05

IPROCH = 1                                SPECIFIED TEMP. DIFF. RATIO= 0.800
IIH ARRAY =   0   0   1   0   1   1
                                               H T COEFF               AREA
INTEGRAL HEATER 1    IN BODY   3          0.10800000E 01          0.29192564  01
INTEGRAL HEATER 2    IN BODY   5          0.17000000E 01          0.21010319  02
INTEGRAL HEATER 3    IN BODY   6          0.10200000E 01          0.59355762  02
                                              TEMP TIHIN              TEMP TIHOUT
INTEGRAL HEATER 1    IN BODY   3          0.90775920E 02          0.11320016  03
INTEGRAL HEATER 2    IN BODY   5          0.70732065E 02          0.84367149  02
INTEGRAL HEATER 3    IN BODY   6          0.56499997E 02          0.70732065E 02
                                              TEMP DIFF               H T RATE
INTEGRAL HEATER 1    IN BODY   3          0.27523236E 02          0.65081383  03
INTEGRAL HEATER 2    IN BODY   5          0.13635083E 02          0.36541525E 03
INTEGRAL HEATER 3    IN BODY   6          0.14232068E 02          0.69001579E 03

NLORD ARRAY =   5
                                              PRODUCT                VAPOR FLOW
LIQUOR FLASH TANK   1                     0.20700153E 05          0.84089173E 03
                                              MASS FRACTION           BPRLFT
LIQUOR FLASH TANK   1                     0.50000000E 00          0.75000000E 01

NCORD ARRAY =   3   4
                                              PRODUCT                VAPOR FLOW
CONDENSATE FLASH TANK   1                 0.10936615E 05          0.36283466E 03
CONDENSATE FLASH TANK   2                 0.10549045E 05          0.38756999E 03


FINAL PRODUCT FLOW RATE =                 20700.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =          48300.00 KGS/HR
STEAM REQUIRED IN BODY(1) =                5471.16 KGS/HR
STEAM REQUIRED IN BODY(2) =                5828.29 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =          11299.45 KGS/HR
STEAM ECONOMY =               4.2745 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =    6
```

PLANT NO. 3C

```
NUMBER CF EFFECTS  6              NUMBER OF BODIES  7
FLOW ORDER    6  7  5  4  1  2  3
IFEED ARRAY  4  1  2  5  7  8  6
DESIGN = 1.CC                     FCHEAT = 1.00
STEAM TEMP. = 146.00             FEED TEMP. =   80.CC
CONDENSATE TEMP. =    53.50      RADIATION LOSS FRACTICN= C.040
AREA RATIO CF BCDY(1) TC BCDY(2) = 1.000
AREA RATIC  1 =   C.7CC0
AREA RATIC  2 =   C.5CC0
NAA         1 =   4
NAA         2 =   2
LIQUOR FLASH TANK  1             CONDENSATE FLASH TANK  2
INTEGRAL HEATER  5               FINISHER EFFECT   1
IBLEED   0                       KALBPR  0
TOTAL FEED FLOW RATE =        3C0000.00
MASS FRACTION FEED = 0.130       MASS FRACTION PRODUCT = 0.52C
NUMBER CF FEED STREAMS  1        IFSCRD ARRAY  6
FEED STREAM  1                      2C0000.C0
MULTIPLE FEED STREAM TC BCDY  1         0.C0
MULTIPLE FEED STREAM TC BODY  2         0.00
MULTIPLE FEED STREAM TC BCDY  3         0.C0
MULTIPLE FEED STREAM TC BCDY  4         C.C0
MULTIPLE FEED STREAM TC BCDY  5         0.C0
MULTIPLE FEED STREAM TC BCDY  6         0.00
MULTIPLE FEED STREAM TC BCDY  7      100000.C0
```

	H T CCEFF	AREA	H T RATE
BODY 1	0.70000000E 00	0.76279981E 03	C.95311297E 04
BODY 2	0.70000000E 00	0.76281352E 03	0.92643163E 04
BODY 3	0.10000000E 01	0.15256321E 04	0.16374829E 05
BODY 4	0.13000000E 01	0.15256122E 04	0.25971520E 05
BODY 5	0.14000000E 01	0.21794365E 04	0.26644539E 05
BODY 6	0.13000000E 01	0.21794246E 04	0.24746717E 05
BODY 7	0.80000000E 00	0.21794732E 04	C.259C0845E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.10452887E 05	0.13250645E 06	C.29212071E C0
BODY 2	0.15134369E 05	0.11837207E 06	0.32946961E 00
BODY 3	0.28645017E 05	0.89726818E 05	C.43465266E C0
BODY 4	0.36430736E 05	0.14395936E 06	0.27090980E 00
BODY 5	0.36584566E 05	0.18039C07E 06	0.21619815E C0
BODY 6	0.37297179E 05	0.16270355E 06	0.15979983E 00
BODY 7	0.45728648E 05	0.21697503E 06	0.17974418E C0
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.14600000E 03	0.12145413E 03	0.1281501CE C3
BODY 2	0.146C0000E 03	0.12815010E 03	0.12865C1CE 03
BODY 3	0.12415010E 03	0.12865010E 03	0.11341695E 03
BODY 4	0.10741696E 03	0.89847814E 02	0.94321824E 02
BODY 5	0.90821824E 02	0.78921065E 02	0.82089376E 02
BODY 6	0.80589376E 02	0.80C0C0C0E 02	0.7185499CE C2
BODY 7	0.70354990E 02	0.71854990E 02	0.55499998E 02

		TEMP CIFF	BPRISE	ENTHALPY V
BODY	1	0.17849859E 02	0.4CCC0CC0E 01	C.2744744CE C4
BODY	2	0.17349899E 02	0.4500C0C00E 01	C.27161593E C4
BODY	3	0.10733144E 02	0.60CCCCC0E 01	0.26932441E C4
BODY	4	0.13095131E 02	0.35CCCCC0E 01	0.26648728E C4
BODY	5	0.87324472E 01	0.15CCCCC0E 01	C.26459591EE C4
BODY	6	0.87343862E 01	0.150C0000E 01	0.2628554CE C4
BODY	7	0.14854592E 02	0.200C0CCCE 01	0.25993625E C4
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.46916935E 03	0.548C1012E 03	0.6146C682E C3
BODY	2	0.54801012E 03	0.55254981E 03	0.6146C882E C3
BCCY	3	0.55254981E 03	0.45791712E 03	0.52113476E C3
BODY	4	0.34221724E 03	0.36435904E 03	0.45017384E C3
BODY	5	0.28858031E 03	0.312666648E 03	C.38C18042E C3
BODY	6	0.31545294E 03	0.27529C25E 03	0.3371756CE C3
BODY	7	0.27529025E 03	0.20293956E 03	0.2942662SE C3

IPRCCF = C
IIH ARRAY = C 0 1 1 1 1 1

SPECIFIEC AREA RATIO = 0.1CC

				H T CCEFF	AREA
INTEGRAL	HEATER	1	IN BCCY 3	0.100C0C00E 01	0.15256321E 03
INTEGRAL	HEATER	2	IN BCCY 4	0.13000000E 01	0.15256122E C3
INTEGRAL	HEATER	3	IN BCCY 5	0.14000000E 01	0.21794364E C3
INTEGRAL	HEATER	4	IN BCCY 6	0.130C0C00E 01	0.21794246E C3
INTEGRAL	HEATER	5	IN BCCY 7	0.800C0C00E 00	0.21794731E C3
				TEMP TIHIN	TEMP TIHOUT
INTEGRAL	HEATER	1	IN BCCY 3	0.10456079E 03	0.12145413E C3
INTEGRAL	HEATER	2	IN BCCY 4	0.94321824E 02	0.10456C79E 03
INTEGRAL	HEATER	3	IN BCCY 5	0.82089376E 02	0.89847814E 02
INTEGRAL	HEATER	4	IN BCCY 6	0.63920748E 02	0.78921065E C2
INTEGRAL	HEATER	5	IN BCCY 7	0.55499598E 02	0.63920748E 02
				TEMP CIFF	H T RATE
INTEGRAL	HEATER	1	IN BCCY 3	0.16893332E 02	0.16959806E C4
INTEGRAL	HEATER	2	IN BCCY 4	0.10238971E 02	0.15816524E 04
INTEGRAL	HEATER	3	IN BCCY 5	0.77584381E 01	0.1480739SE 04
INTEGRAL	HEATER	4	IN BCCY 6	0.15000316E 02	0.25973401E C4
INTEGRAL	HEATER	5	IN BCCY 7	0.84207506E 01	0.18558028E 04

```
NLCRD ARRAY =  5
                                        PRCCUCT              VAPCR FLOW
LICLCR FLASH TANK  1            0.75CC0CC7E 05        0.34766S5CE C4
                                       MASS FRACTION            BPRLFT
LICLCR FLASH TANK  1            0.52CCCCCOE 00        0.8CCCCCCCE C1

NCCRD ARRAY =  3  4
                                        PRCCUCT              VAPCR FLOW
CONCENSATE FLASH TANK  1        0.32021404E 05        0.1132236SE C4
CONCENSATE FLASH TANK  2        0.31086771E 05        0.S3463352E 03

NVCRD =  4
NUMBER CF LICLCR FLASH TANK BEFCRE FINISHER  0
FINISHER CCNCENSATE FLASH TANK  0
RADIATION LCSS FRACTICN IN FINISHER =   0.C2C0
STEAM TEMP. =       177.000              LICUCR TEMP. =      114.S17
TEMF. DIFF. =        62.083              BFRFIN =              7.5CC
ENTHALPY HLFINC = 0.46533126E 03         ENTHALPY VFINC = 0.26948142E 04
PRCCUCT =         0.78476820E 05         VAFOR FLOW =     0.1124SS97E C5
MASS FRACTICN =   0.4S69620 3E 00        H T RATE =       0.71S19232E C4
H T CCEFF =       0.50000000E 00         AREA =           0.2303S86CE C3


FINAL PRCCUCT FLCW RATE =            7500C.00 KGS/HR
TOTAL EVAPCRATICN IN THE PLANT =    22500C.C0 KGS/HR
STEAM RECUIREC IN BCCY(1) =           16812.29 KGS/HR
STEAM RECUIREC IN BCCY(2) =           16341.35 KGS/HR
TOTAL STEAM RECUIREC IN BCCIES =      33153.64 KGS/HR
STEAM RECUIREC IN FINISHER EFFECT =   12976.84 KGS/HR
STEAM ECCNCMY =              4.8775 KGS VAPCR/KG STEAM
NUMBER CF ITERATICNS =  9
```

FLANT NO. 31

```
NUMBER CF EFFECTS  6                    NUMBER CF BCCIES  7
FLCW CRDER    6  7  5  4  3  1  2
IFEEC ARRAY   3  1  4  5  7  8  6
DESIGN = 1.CC                           FCHEAT = 1.CC
STEAM TEMP. =  145.0J                   FEEC TEMP. =   88.C0
CCNDENSATE TEMP. =    54.50             RACIATION LOSS FRACTION= C.C40
APEA RATIC CF RCCY(1) TC ECCY(2) = 1.C00
AREA RATIC  1 =   C.8930
AREA RATIC  2 =   0.6C70
AREA RATIC  3 =   C.4640
NAA        1 =   5
NAA        2 =   3
NAA        3 =   2
LIGUCR FLASH TANK  1                    CCNCENSATE FLASH TANK  C
INTEGRAL HEATER  5                      FINISHER EFFECT  1
IDLEEC  C                               KALBPR  0
TOTAL FEEC FLCW RATE =       45CC00.00
MASS FRACTICN FEEC = 0.150              MASS FRACTION PRCCUCT = 0.67C
NUMBER CF FEEC STREAMS  1               IFSCRC ARRAY  6
FEEC STREAM  1                            3CCCC0.C0
MULTIFLE FEEC STREAM TC ECCY  1             0.C0
MULTIFLE FEEC STREAM TC ECCY  2             0.C0
MULTIFLC FEEC STREAM TC ECCY  3             C.C0
MULTIFLC FEEC STREAM TC ECCY  4             0.CC
MULTIFLE FEEC STREAM TC ECCY  5          15CCCC.C0
MULTIFLE FEEC STREAM TC ECCY  6             0.C0
MULTIFLE FEEC STREAM TC ECCY  7             0.C0
```

	H T CCEFF	AREA	H T RATE
BODY 1	0.11350000E 01	0.86172987E 03	0.1939615CE C5
BODY 2	0.85CCCCC0E 0C	0.86172382E 03	0.13426951E C5
BODY 3	0.14200000E 01	0.18572038E 04	0.29427662E C5
BCDY 4	0.14750C00E 01	0.30596552E 04	0.37243567E C5
BODY 5	0.144C0000E 01	0.30596574E 04	0.35168754E 05
BODY 6	0.125CCCC0E 01	0.34262723E 04	0.38070627E C5
PODY 7	0.85500000E 0C	0.34262787E 04	C.436C9397E C5

	VAFCR FLCW	PRCCUCT	MASS FRACTION
BCDY 1	0.26028C90E 05	0.145998C3E 06	0.46233500E C0
BCCY 2	0.21466876E 05	0.1245309CE 06	0.542C3385E C0
BODY 3	0.40621419E 05	0.172C2632E 06	0.39238181E C0
BODY 4	0.53323184E 05	0.21264785E 06	0.31742620E C0
BODY 5	0.50213632E 05	0.26597105E 06	0.25378702E C0
BODY 6	0.63095241E 05	0.236905C5E 06	0.18994952E C0
BCCY 7	0.70720612E 05	0.16618449E 06	0.27078335E C0

	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.145C0000E 03	0.11693711E 03	0.12516882E C3
BODY 2	0.14500000E 03	0.12516882E 03	0.12666882E C3
BODY 3	0.11916882E 03	0.101855976E 03	0.10801027E 03
BCDY 4	0.10351027E 03	0.906613C7E 02	0.95257745E 02
BODY 5	0.92257745E 02	0.795C2282E 02	0.84275562E C2
BODY 6	0.82275561E 02	0.88CC0CC0E 02	0.73386454E C2
BODY 7	0.71386454E 02	0.73386454E 02	0.56499998E C2

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.19831179E 02	0.6000CCCCE 01	C.27455933E C4
BODY	2	0.18331179E 02	0.75CCCCCCE 01	C.27122174E C4
BODY	3	0.11158553E 02	0.45CCCCCCE 01	0.2685723CE C4
BODY	4	0.82525234E 01	0.30CC0CCCE 01	C.26666446E C4
PODY	5	0.79821832E 01	0.20CCCCCOE 01	0.26493302E C4
BODY	6	0.88891C69E 01	0.20CCCCCOE 01	C.263C859CE C4
BODY	7	0.14886455E 02	0.200CCCCCE C1	C.26C1150CE C4
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	C.46284559E 03	0.53415252E 03	0.6103C538E C3
BODY	2	0.53415252E 03	0.54684722E 03	C.61030538E C3
BODY	3	0.38928168E 03	0.4275125CE C3	0.49956451E C3
BODY	4	0.34175543E 03	0.364C5C47E 03	C.43366136E C3
BODY	5	0.27C97C34E 03	0.31768382E 03	C.38622503E C3
BODY	6	0.34860639E 03	0.27736377E C3	0.34425447E C3
BODY	7	0.27736377E 03	0.19257C88E C3	0.29858685E C3

IPRICH = 1
IIH ARRAY = 0   0   1   1   1   1   1

SPECIFIED TEMP. DIFF. RATIO= C.8C0

				H T CCEFF	AREA
INTEGRAL	HEATER	1	IN BCCY 3	0.142CCCCCE 01	0.17759327E C3
INTEGRAL	HEATER	2	IN BCCY 4	0.1475CCCCE C1	0.204C6404E C3
INTEGRAL	HEATER	3	IN BCCY 5	0.144C0CCCE 01	0.25787039E C3
INTEGRAL	HEATER	4	IN BCCY 6	0.125CCCCCE 01	0.26529822E C3
INTEGRAL	HEATER	5	IN PCCY 7	0.855C0CCCE 0C	0.24535944E C3
				TEMP TIHIN	TEMP TIHOLT
INTEGRAL	HEATER	1	IN BCCY 3	0.108C1C27E C3	0.11693711E C3
INTEGRAL	HEATER	2	IN BCCY 4	0.95257745E 02	0.101859766E C3
INTEGRAL	HEATER	3	IN BCCY 5	0.84275562E 02	0.90661307E C2
INTEGRAL	HEATER	4	IN BCCY 6	0.684C9163E 02	0.79502282E C2
INTEGRAL	HEATER	5	IN BCCY 7	0.56499598E 02	0.684C9163E C2
				TEMP DIFF	H T RATE
INTEGRAL	HEATER	1	IN BCCY 3	0.89268418E 01	0.16883948E C4
INTEGRAL	HEATER	2	IN BCCY 4	0.66020183E 01	0.149C3783E 04
INTEGRAL	HEATER	3	IN BCCY 5	0.63857460E 01	0.17784307E C4
INTEGRAL	HEATER	4	IN BCCY 6	0.11093119E 02	0.27590483E C4
INTEGRAL	HEATER	5	IN BCCY 7	0.115C9164E 02	C.18737491E C4

```
NLCRD ARRAY =  6
                                        PRODUCT              VAPOR FLOW
LIQUOR FLASH TANK   1                0.10074620E 06      C.63219824E C4
                                      MASS FRACTION           BPRLFT
LIQUOR FLASH TANK   1                0.670CCCCCE 0C      0.12CCCCCE C2

NVCRD =  4
NUMBER CF LIQUCR FLASH TANK BEFCRE FINISHER   0
FINISHER CCNDENSATE FLASH TANK   0
RADIATICN LCSS FRACTICN IN FINISHER =   0.C2CC
STEAM TEMP. =       157.0CC            LIQUCR TEMP. =      114.510
TEMP. CIFF. =        42.490            BPRFIN =             11.CCC
ENTHALPY HLFINC = C.45824441E 03      ENTHALPY VFINC = 0.26925265E C4
PRCCLCT =          0.10706828E C6      VAPCR FLOW =       C.17462682E C5
MASS FRACTICN =    0.63043883E C0      H T RATE =         0.77729905E C4
H T CCEFF =        0.6CCCCOC0E C0      AREA =             0.30489682E C3


FINAL PRCDUCT FLCW RATE =            100746.27 KGS/HR
TOTAL EVAPCRATICN IN THE PLANT =     349253.73 KGS/HR
STEAM REGUIRED IN BCCY(1) =           34163.95 KGS/HR
STEAM REGUIRED IN BCCY(2) =           23650.1C KGS/HR
TOTAL STEAM REGUIRED IN BCCIES =      57814.05 KGS/HR
STEAM REGUIRED IN FINISHER EFFECT =   13652.42 KGS/HR
STEAM ECCNCMY =            4.8870 KGS VAPCR/KG STEAM
NUMBER CF ITERATICNS =  9
```

PLANT NO. 32

```
NUMBER OF EFFECTS  5                    NUMBER OF BODIES  6
FLOW ORDER    1  2  3  4  5  6
IFEED ARRAY  7  1  2  3  4  5
DESIGN =  1.00                          FCHEAT =  1.00
STEAM TEMP. =  134.50                   FEED TEMP. =  117.20
CONDENSATE TEMP. =   63.90              RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
AREA RATIO  1 =   1.4300
AREA RATIO  2 =   0.7000
NAA         1 =  5
NAA         2 =  2
LIQUOR FLASH TANK  0                    CONDENSATE FLASH TANK  1
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  1                               KALBPR  0
TOTAL FEED FLOW RATE =      103900.00
MASS FRACTION FEED = 0.130              MASS FRACTION PRODUCT = 0.600
NUMBER OF FEED STREAMS  1               IFSORD ARRAY  1
FEED STREAM  1                              103900.00
MULTIPLE FEED STREAM TO BODY  1                  0.00
MULTIPLE FEED STREAM TO BODY  2                  0.00
MULTIPLE FEED STREAM TO BODY  3                  0.00
MULTIPLE FEED STREAM TO BODY  4                  0.00
MULTIPLE FEED STREAM TO BODY  5                  0.00
MULTIPLE FEED STREAM TO BODY  6                  0.00
```

```
                      H T COEFF               AREA                  H T RATE
BODY  1          0.27150000E 01       0.32588952E 03       0.11273415E 05
BODY  2          0.24150000E 01       0.32588724E 03       0.10027664E 05
BODY  3          0.17600000E 01       0.46554650E 03       0.95430943E 04
BODY  4          0.14990000E 01       0.46553520E 03       0.80525332E 04
BODY  5          0.12380000E 01       0.46556609E 03       0.67969491E 04
BODY  6          0.76100000E 00       0.32559163E 03       0.41699909E 04
                      VAPOR FLOW              PRODUCT             MASS FRACTION
BODY  1          0.17479191E 05       0.86420701E 05       0.15629357E 00
BODY  2          0.16423114E 05       0.69997480E 05       0.19296409E 00
BODY  3          0.16831587E 05       0.53165412E 05       0.25405616E 00
BODY  4          0.13409230E 05       0.39756336E 05       0.33974459E 00
BODY  5          0.10850827E 05       0.28905923E 05       0.46727448E 00
BODY  6          0.64522257E 04       0.22453826E 05       0.60000000E 00
                      TEMP C                  TEMP TIN             TEMP TOUT
BODY  1          0.13450000E 03       0.11720000E 03       0.12175865E 03
BODY  2          0.13450000E 03       0.12175865E 03       0.12175865E 03
BODY  3          0.12120865E 03       0.12175865E 03       0.10956167E 03
BODY  4          0.10846167E 03       0.10956167E 03       0.96922398E 02
BODY  5          0.95822398E 02       0.96922398E 02       0.84029731E 02
BODY  6          0.82929730E 02       0.84029731E 02       0.66099998E 02
                      TEMP DIFF               BPRISE              ENTHALPY V
BODY  1          0.12741345E 02       0.55000000E 00       0.27263054E 04
BODY  2          0.12741345E 02       0.55000000E 00       0.27078791E 04
BODY  3          0.11646984E 02       0.11000000E 01       0.26896937E 04
BODY  4          0.11539271E 02       0.11000000E 01       0.26702825E 04
BODY  5          0.11792667E 02       0.11000000E 01       0.26494754E 04
BODY  6          0.16829733E 02       0.22000000E 01       0.26180260E 04
```

```
                    ENTHALPY LIN           ENTHALPY LOUT          ENTHALPY C
BODY    1      0.45560841E 03         0.46595777E 03         0.56527501E 03
BODY    2      0.46595777E 03         0.45567615E 03         0.56527501E 03
BODY    3      0.45567615E 03         0.39461645E 03         0.50862847E 03
BODY    4      0.39461645E 03         0.32996809E 03         0.45459252E 03
BODY    5      0.32996809E 03         0.26139871E 03         0.40124211E 03
BODY    6      0.26139871E 03         0.18542080E 03         0.34700156E 03

ICBLED =   1
                                            QBLEED                 VBLEED
BLEED  STREAM  FROM  BODY   1           0.                     0.
BLEED  STREAM  FROM  BODY   2           0.11810000E 05         0.19332040E 05
BLEED  STREAM  FROM  BODY   3           0.29200000E 04         0.47031428E 04
BLEED  STREAM  FROM  BODY   4           0.24200000E 04         0.38395086E 04
BLEED  STREAM  FROM  BODY   5           0.37500000E 04         0.58632588E 04
BLEED  STREAM  FROM  BODY   6           0.                     0.

NCORD ARRAY =   3
                                           PRODUCT               VAPOR FLOW
CONDENSATE FLASH TANK   1               0.35687499E 05         0.90458225E 03


FINAL PRODUCT FLOW RATE =               22453.83 KGS/HR
TOTAL EVAPORATION IN THE PLANT =        81388.33 KGS/HR
STEAM REQUIRED IN BODY(1) =             19365.98 KGS/HR
STEAM REQUIRED IN BODY(2) =             17226.10 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =        36592.08 KGS/HR
STEAM ECONOMY =                    2.2242 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 14
```

PLANT NO. 33

NUMBER OF EFFECTS 4   NUMBER OF BODIES 4
FLOW ORDER   1 2 3 4
IFEED ARRAY   5 1 2 3
DESIGN = 1.00   FCHEAT = 1.00
STEAM TEMP. = 147.78   FEED TEMP. =   50.00
CONDENSATE TEMP. =   49.44   RADIATION LOSS FRACTION= 0.040
AREA RATIO 1 = 1.0000
LIQUOR FLASH TANK 0   CONDENSATE FLASH TANK 3
INTEGRAL HEATER 4   FINISHER EFFECT 0
IBLEED 0
TOTAL FEED FLOW RATE =   45359.00
MASS FRACTION FEED = 0.075   MASS FRACTION PRODUCT = 0.200
NUMBER OF FEED STREAMS 1   IFSORD ARRAY   1
FEED STREAM 1   45359.00
MULTIPLE FEED STREAM TO BODY   1   0.00
MULTIPLE FEED STREAM TO BODY   2   0.00
MULTIPLE FEED STREAM TO BODY   3   0.00
MULTIPLE FEED STREAM TO BODY   4   0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.85175999E 00	0.25903208E 03	0.44944220E 04
BODY	2	0.90854400E 00	0.25911226E 03	0.39326686E 04
BODY	3	0.10788960E 01	0.25910892E 03	0.45838189E 04
BODY	4	0.11356800E 01	0.25911701E 03	0.52673717E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.61085971E 04	0.39250123E 05	0.86673000E-01
BODY	2	0.67063753E 04	0.32543585E 05	0.10453440E 00
BODY	3	0.72709710E 04	0.25272704E 05	0.13460870E 00
BODY	4	0.82634326E 04	0.77153949E 04	0.20000000E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.14777778E 03	0.11382504E 03	0.12740251E 03
BODY	2	0.12268028E 03	0.12740251E 03	0.10597115E 03
BODY	3	0.10041559E 03	0.10597115E 03	0.84014793E 02
BODY	4	0.76792571E 02	0.84014793E 02	0.59888889E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.20375275E 02	0.47222222E 01	0.27183018E 04
BODY	2	0.16709130E 02	0.55555555E 01	0.26867137E 04
BODY	3	0.16400798E 02	0.72222222E 01	0.26516267E 04
BODY	4	0.17903687E 02	0.94444444E 01	0.26077921E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.47351849E 03	0.53645779E 03	0.62226617E 03
BODY	2	0.53645779E 03	0.43586502E 03	0.51488350E 03
BODY	3	0.43586502E 03	0.33264561E 03	0.42059230E 03
BODY	4	0.33264561E 03	0.21370564E 03	0.32124617E 03

```
IPROCH =  0
IIH ARRAY =  1  1  1  1                    SPECIFIED AREA RATIO = 0.100

                                              H T COEFF              AREA
INTEGRAL HEATER 1   IN BODY  1             0.85175999E 00         0.25903207E 02
INTEGRAL HEATER 2   IN BODY  2             0.90854400E 00         0.25911225E 02
INTEGRAL HEATER 3   IN BODY  3             0.10788960E 01         0.25910392E 02
INTEGRAL HEATER 4   IN BODY  4             0.11356800E 01         0.25911701E 02
                                             TEMP TIHIN            TEMP TIHOUT
INTEGRAL HEATER 1   IN BODY  1             0.95343916E 02         0.11382504E 03
INTEGRAL HEATER 2   IN BODY  2             0.78891288E 02         0.95343916E 02
INTEGRAL HEATER 3   IN BODY  3             0.62256610E 02         0.78891288E 02
INTEGRAL HEATER 4   IN BODY  4             0.50000000E 02         0.62256610E 02
                                             TEMP DIFF             H T RATE
INTEGRAL HEATER 1   IN BODY  1             0.18481128E 02         0.95347778E 03
INTEGRAL HEATER 2   IN BODY  2             0.16452624E 02         0.83689331E 03
INTEGRAL HEATER 3   IN BODY  3             0.16634678E 02         0.83395848E 03
INTEGRAL HEATER 4   IN BODY  4             0.12256613E 02         0.60784897E 03

NCORD ARRAY =  2  3  4
                                              PRODUCT              VAPOR FLOW
CONDENSATE FLASH TANK  1                   0.76319064E 04         0.31780760E 03
CONDENSATE FLASH TANK  2                   0.73223995E 04         0.30940703E 03
CONDENSATE FLASH TANK  3                   0.70279147E 04         0.29449460E 03


FINAL PRODUCT FLOW RATE =                 7715.39 KGS/HR
TOTAL EVAPORATION IN THE PLANT =         28349.37 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =          7949.61 KGS/HR
STEAM ECONOMY =                3.5661 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 12
```

```
NUMBER OF EFFECTS  3                      NUMBER OF BODIES  3
FLOW CRDER    1   2   3
IFEED ARRAY  4   1   2
DESIGN =  1.00                            FCHEAT =   0.00
STEAM TEMP. =  113.20                     FEED TEMP. =    37.80
CONDENSATE TEMP. =    38.30               RADIATION LOSS FRACTION= 0.000
AREA RATIO  1 =  1.0000
LIQUOR FLASH TANK  0                      CONDENSATE FLASH TANK  0
INTEGRAL HEATER  0                        FINISHER EFFECT  0
IBLEED  0                                 KALBPR  0
TOTAL FEED FLCW RATE =         45360.00
MASS FRACTION FEED = 0.100                MASS FRACTION PROCUCT = 0.500
NUMBER OF FEED STREAMS  1                 IFSORD ARRAY  1
FEED STREAM  1                               45360.00
MULTIPLE FEED STREAM TC BODY  1                  0.00
MULTIPLE FEED STREAM TC BODY  2                  0.00
MULTIPLE FEED STREAM TC BODY  3                  0.00
```

		H T CCEFF	AREA	H T RATE
BODY	1	0.62500000E 01	0.32196226E 03	0.10746398E 05
BODY	2	0.34100000E 01	0.32196898E 03	0.71157194E 04
BODY	3	0.22670000E 01	0.32194758E 03	0.76915226E 04
		VAPCR FLCW	PRCDUCT	MASS FRACTION
BODY	1	0.11363257E 05	0.33997032E 05	0.13342341E 00
BODY	2	0.12048676E 05	0.21947848E 05	0.20667174E 00
BODY	3	0.12876066E 05	0.90720015E 04	0.50000000E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.11320000E 03	0.37800000E 02	0.10785955E 03
BODY	2	0.10285955E 03	0.10785955E 03	0.96378422E 02
BODY	3	0.87718421E 02	0.96378422E 02	0.77179997E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.53404513E 01	0.50000000E 01	0.26852478E 04
BODY	2	0.64811251E 01	0.86600000E 01	0.26652599E 04
BODY	3	0.10538423E 02	0.38880000E 02	0.26106044E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.15826104E 03	0.45158635E 03	0.47465108E 03
BODY	2	0.45158635E 03	0.40351718E 03	0.43091254E 03
BODY	3	0.40351718E 03	0.32313721E 03	0.36712501E 03

```
FINAL PRODUCT FLCW RATE =              9072.00 KGS/HR
TOTAL EVAPCRATION IN THE PLANT =      36288.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =      17418.93 KGS/HR
STEAM ECONOMY =          2.0833 KGS VAPCR/KG STEAM
NUMBER OF ITERATICNS =   4
```

PLANT NO. 35

```
NUMBER OF EFFECTS    3              NUMBER OF BODIES   3
FLOW ORDER     1   2   3
IFEED ARRAY   4   1   2
DESIGN =   1.00                     FCHEAT =   0.00
STEAM TEMP. =   131.00              FEED TEMP. =   37.80
CONDENSATE TEMP. =   38.30          RADIATION LOSS FRACTION= 0.000
AREA RATIO   1 =   1.0000
LIQUOR FLASH TANK   0               CONDENSATE FLASH TANK   0
INTEGRAL HEATER   0                 FINISHER EFFECT   0
IBLEED   0                          KALBPR   0
TOTAL FEED FLOW RATE =       45360.00
MASS FRACTION FEED = 0.100          MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS   1          IFSCRD ARRAY   1
FEED STREAM   1                        45360.00
MULTIPLE FEED STREAM TO BODY   1           0.00
MULTIPLE FEED STREAM TO BODY   2           0.00
MULTIPLE FEED STREAM TO BODY   3           0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.62500000E 01	0.17830256E 03	0.11178575E 05
BODY	2	0.34100000E 01	0.17831118E 03	0.68530878E 04
BODY	3	0.22670000E 01	0.17829376E 03	0.76223043E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.11120355E 05	0.34240120E 05	0.13247617E 00
BODY	2	0.12054350E 05	0.22185066E 05	0.20446187E 00
BODY	3	0.13113293E 05	0.90720008E 04	0.50000000E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13100000E 03	0.37800000E 02	0.12096889E 03
BODY	2	0.11596889E 03	0.12096889E 03	0.10469813E 03
BODY	3	0.96038127E 02	0.10469813E 03	0.77179997E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.10031107E 02	0.50000000E 01	0.27049418E 04
BODY	2	0.11270763E 02	0.86600000E 01	0.26785326E 04
BODY	3	0.18858130E 02	0.38880000E 02	0.26106044E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.15826104E 03	0.50647256E 03	0.55032311E 03
BODY	2	0.50647256E 03	0.43835012E 03	0.48638698E 03
BODY	3	0.43835012E 03	0.32313721E 03	0.40215147E 03

```
FINAL PRODUCT FLOW RATE =            9072.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    36288.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    18539.29 KGS/HR
STEAM ECONOMY =             1.9574 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   4
```

PLANT NO. 36

NUMBER OF EFFECTS   3   NUMBER OF BODIES   3

FLOW ORDER   3   2   1
IFEED ARRAY   2   3   4
DESIGN =   1.00   FCHEAT =   0.00
STEAM TEMP. =   113.20   FEED TEMP. =   37.80
CONDENSATE TEMP. =   38.30   RADIATION LOSS FRACTION= 0.000
AREA RATIO   1 =   1.0000
LIQUOR FLASH TANK   0   CONDENSATE FLASH TANK   0
INTEGRAL HEATER   0   FINISHER EFFECT   0
IBLEED   0   KALBPR   0
TOTAL FEED FLOW RATE =   45360.00
MASS FRACTION FEED = 0.100   MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS   1   IFSORD ARRAY   3
FEED STREAM   1   45360.00
MULTIPLE FEED STREAM TO BODY   1   0.00
MULTIPLE FEED STREAM TO BODY   2   0.00
MULTIPLE FEED STREAM TO BODY   3   0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.34100000E 01	0.29585773E 03	0.89480461E 04
BODY	2	0.34100000E 01	0.29586601E 03	0.86663746E 04
BODY	3	0.56780000E 01	0.29588929E 03	0.82335840E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.13781918E 05	0.90720027E 04	0.50000000E 00
BODY	2	0.12817464E 05	0.22854009E 05	0.19847721E 00
BODY	3	0.96886142E 04	0.35670559E 05	0.12716369E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.11320000E 03	0.90740769E 02	0.10433067E 03
BODY	2	0.99330667E 02	0.77179998E 02	0.90740769E 02
BODY	3	0.82080769E 02	0.37800000E 02	0.77179998E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.88693321E 01	0.50000000E 01	0.26797980E 04
BODY	2	0.85898981E 01	0.86600000E 01	0.26559769E 04
BODY	3	0.49007696E 01	0.38880000E 02	0.26106044E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.37991345E 03	0.43681164E 03	0.47465108E 03
BODY	2	0.32313722E 03	0.37991345E 03	0.41603839E 03
BODY	3	0.15826104E 03	0.32313722E 03	0.34343655E 03

FINAL PRODUCT FLOW RATE =   9072.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   36288.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   14503.97 KGS/HR
STEAM ECONOMY =   2.5019 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   4

PLANT NO. 37

NUMBER OF EFFECTS   3   NUMBER OF BODIES   3
FLOW ORDER   1   2   3
IFEED ARRAY   4   1   2
DESIGN = 1.00   FCHEAT = 0.00
STEAM TEMP. = 120.50   FEED TEMP. =   21.10
CONDENSATE TEMP. =   51.60   RADIATION LOSS FRACTION= 0.000
AREA RATIO 1 = 1.0000
LIQUOR FLASH TANK 0   CONDENSATE FLASH TANK 0
INTEGRAL HEATER 0   FINISHER EFFFCT 0
IBLEED 0   KALBPR 0
TOTAL FEED FLOW RATE =   24390.00
MASS FRACTION FEED = 0.100   MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS 1   IFSORD ARRAY   1
FEED STREAM 1   24390.00
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.31220000E 01	0.10890662E 03	0.60847304E 04
BODY	2	0.19880000E 01	0.10889047E 03	0.37723585E 04
BODY	3	0.11335000E 01	0.10889836E 03	0.41447082E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.60363416E 04	0.18354011E 05	0.13288649E 00
BODY	2	0.64998216E 04	0.11853663E 05	0.20575918E 00
BODY	3	0.69758362E 04	0.48780001E 04	0.50000000E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.12050000E 03	0.21100000E 02	0.10260407E 03
BODY	2	0.10260407E 03	0.10260407E 03	0.85177712E 02
BODY	3	0.85177712E 02	0.85177712E 02	0.51600000E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.17895926E 02	0.	0.26796218E 04
BODY	2	0.17426362E 02	0.	0.26520388E 04
BODY	3	0.33577713E 02	0.	0.25938667E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.88341479E 02	0.42958274E 03	0.50561774E 03
BODY	2	0.42958274E 03	0.35662204E 03	0.42983346E 03
BODY	3	0.35662204E 03	0.21603888E 03	0.35644509E 03

FINAL PRODUCT FLOW RATE =   4878.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   19512.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   9953.81 KGS/HR
STEAM ECONOMY =   1.9603 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   3

PLANT NO. 38

NUMBER OF EFFECTS   4
FLOW ORDER   1   2   3   4
IFEED ARRAY   5   1   2   3
DESIGN = 1.00
STEAM TEMP. = 127.00
CONDENSATE TEMP. =   49.00
AREA RATIO   1 =   1.0000
LIQUOR FLASH TANK   0
INTEGRAL HEATER   0
IBLEED   0
TOTAL FEED FLOW RATE =   39900.00
MASS FRACTION FEED = 0.050
NUMBER OF FEED STREAMS   1
FEED STREAM   1
MULTIPLE FEED STREAM TO BODY   1
MULTIPLE FEED STREAM TO BODY   2
MULTIPLE FEED STREAM TO BODY   3
MULTIPLE FEED STREAM TO BODY   4

NUMBER OF BODIES   4

FCHEAT =   0.00
FEED TEMP. =   83.30
RADIATION LOSS FRACTION= 0.000

CONDENSATE FLASH TANK   0
FINISHER EFFECT   0
KALBPR   0

MASS FRACTION PRODUCT = 0.200
IFSORD ARRAY   1
          39900.00
             0.00
             0.00
             0.00
             0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.28400000E 01	0.10673393E 03	0.51710707E 04
BODY	2	0.25550000E 01	0.10673038E 03	0.39338900E 04
BODY	3	0.22670000E 01	0.10673454E 03	0.44966534E 04
BODY	4	0.17000000E 01	0.10673535E 03	0.50681046E 04
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.63509128E 04	0.33548924E 05	0.59465393E-01
BODY	2	0.71353306E 04	0.26413687E 05	0.75529023E-01
BODY	3	0.78764287E 04	0.18537380E 05	0.10762039E 00
BODY	4	0.85623274E 04	0.99749999E 04	0.20000000E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.12700000E 03	0.83300000E 02	0.10994076E 03
BODY	2	0.10994076E 03	0.10994076E 03	0.95514850E 02
BODY	3	0.95514850E 02	0.95514850E 02	0.76931119E 02
BODY	4	0.76931119E 02	0.76931119E 02	0.48999998E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.17059238E 02	0.	0.26907671E 04
BODY	2	0.14425911E 02	0.	0.26686498E 04
BODY	3	0.18583730E 02	0.	0.26382548E 04
BODY	4	0.27931121E 02	0.	0.25891997E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.34876044E 03	0.46029998E 03	0.53326721E 03
BODY	2	0.46029998E 03	0.39990157E 03	0.46085073E 03
BODY	3	0.39990157E 03	0.32209521E 03	0.39994581E 03
BODY	4	0.32209521E 03	0.20515319E 03	0.32182718E 03

FINAL PRODUCT FLOW RATE =   9975.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   29925.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   8530.69 KGS/HR
STEAM ECONOMY =   3.5079 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 5

PLANT NO. 39

NUMBER OF EFFECTS 4		NUMBER OF BODIES 4
FLOW ORDER 3 4 2 1		
IFEED ARRAY 2 4 5 3		
DESIGN = 1.00		FCHEAT = 0.00
STEAM TEMP. = 147.50		FEED TEMP. = 15.55
CONDENSATE TEMP. = 53.40		RADIATION LOSS FRACTION= 0.000
AREA RATIO 1 = 1.0000		
LIQUOR FLASH TANK 0		CONDENSATE FLASH TANK 0
INTEGRAL HEATER 0		FINISHER EFFECT 0
IBLEED 0		KALBPR 0

TOTAL FEED FLOW RATE = 5310.00

MASS FRACTION FEED = 0.100	MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS 1	IFSORD ARRAY 3
FEED STREAM 1	5310.00
MULTIPLE FEED STREAM TO BODY 1	0.00
MULTIPLE FEED STREAM TO BODY 2	0.00
MULTIPLE FEED STREAM TO BODY 3	0.00
MULTIPLE FEED STREAM TO BODY 4	0.00

	H T COEFF	AREA	H T RATE
BODY 1	0.19880000E 01	0.35059763E 02	0.10050327E 04
BODY 2	0.17000000E 01	0.35065472E 02	0.91163574E 03
BODY 3	0.17000000E 01	0.35068212E 02	0.79396336E 03
BODY 4	0.14200000E 01	0.35071506E 02	0.46611142E 03
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.14582147E 04	0.10620002E 04	0.50000000E 00
BODY 2	0.12465491E 04	0.25202791E 04	0.21069095E 00
BODY 3	0.71844649E 03	0.45916546E 04	0.11564458E 00
BODY 4	0.82478945E 03	0.37667898E 04	0.14096884E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.14750000E 03	0.95577343E 02	0.13308035E 03
BODY 2	0.11087034E 03	0.61739998E 02	0.95577343E 02
BODY 3	0.88917342E 02	0.15550000E 02	0.75599375E 02
BODY 4	0.71099376E 02	0.75599375E 02	0.61739998E 02
	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.14419655E 02	0.22210000E 02	0.27154065E 04
BODY 2	0.15293001E 02	0.66600000E 01	0.26651119E 04
BODY 3	0.13317966E 02	0.45000000E 01	0.26329808E 04
BODY 4	0.93593778E 01	0.83400001E 01	0.26058197E 04
	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.30374480E 03	0.39924104E 03	0.62106913E 03
BODY 2	0.21392909E 03	0.30374480E 03	0.46478534E 03
BODY 3	0.58467999E 02	0.27813010E 03	0.37216728E 03
BODY 4	0.27813010E 03	0.21392909E 03	0.29738430E 03

FINAL PRODUCT FLOW RATE = 1062.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT = 4248.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES = 1705.58 KGS/HR
STEAM ECONOMY = 2.4906 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 4

PLANT NO. 40

```
NUMBER OF EFFECTS   3                    NUMBER OF BODIES   3
FLOW ORDER    2   3   1
IFEED ARRAY  3   4   2
DESIGN =   1.00                          FCHEAT  =   0.00
STEAM TEMP. =  138.00                    FEED TEMP. =    82.30
CONDENSATE TEMP. =    37.80              RADIATION LOSS FRACTION= 0.000
AREA RATIO  1 =   1.0000
LIQUOR FLASH TANK   0                    CONDENSATE FLASH TANK   0
INTEGRAL HEATER   0                      FINISHER EFFECT   0
IBLEED   0                               KALBPR   0
TOTAL FEED FLOW RATE =          26600.00
MASS FRACTION FEED = 0.100               MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS   1               IFSORD ARRAY   2
FEED STREAM   1                              26600.00
MULTIPLE FEED STREAM TO BODY   1                 0.00
MULTIPLE FEED STREAM TO BODY   2                 0.00
MULTIPLE FEED STREAM TO BODY   3                 0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.39650000E 01	0.29478716E 02	0.49288978E 04
BODY 2	0.56780000E 01	0.29481708E 02	0.41275767E 04
BODY 3	0.45450000E 01	0.29485086E 02	0.44723258E 04
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.65520922E 04	0.53200009E 04	0.50000000E 00
BODY 2	0.69079420E 04	0.19692467E 05	0.13507703E 00
BODY 3	0.78199644E 04	0.11872489E 05	0.22404737E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13800000E 03	0.37800000E 02	0.95830538E 02
BODY 2	0.95830538E 02	0.82300000E 02	0.71173146E 02
BODY 3	0.71173146E 02	0.71173146E 02	0.37800000E 02
	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.42169463E 02	0.	0.26691438E 04
BODY 2	0.24657391E 02	0.	0.26283981E 04
BODY 3	0.33373146E 02	0.	0.25690058E 04
	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.15826104E 03	0.40122329E 03	0.58025488E 03
BODY 2	0.34457364E 03	0.29798773E 03	0.40127641E 03
BODY 3	0.29798773E 03	0.15826104E 03	0.29769332E 03

```
FINAL PRODUCT FLOW RATE =             5320.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =     21280.00 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =      8252.64 KGS/HR
STEAM ECONOMY =              2.5786 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   4
```

APPENDIX   E

PROCESS DESIGN OF EVAPORATION PLANTS
BY MEEDS — PROGRAM OUTPUTS

PLANT NO. 101

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5  10  8  8
DESIGN =  0.00                          FCHEAT =  1.00
STEAM TEMP. =  150.00                   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  1
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                               75531.50
FEED STREAM  2                               75531.50
MULTIPLE FEED STREAM TO BODY  1                 0.00
MULTIPLE FEED STREAM TO BODY  2                 0.00
MULTIPLE FEED STREAM TO BODY  3                 0.00
MULTIPLE FEED STREAM TO BODY  4                 0.00
MULTIPLE FEED STREAM TO BODY  5                 0.00
MULTIPLE FEED STREAM TO BODY  6                 0.00
MULTIPLE FEED STREAM TO BODY  7                 0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.81148969E 00	0.38111000E 03	0.57462049E 04
BODY	2	0.11287027E 01	0.38107000E 03	0.86621075E 04
BODY	3	0.18283866E 01	0.76216000E 03	0.13413145E 05
BODY	4	0.18004362E 01	0.76214000E 03	0.13716584E 05
BODY	5	0.14738801E 01	0.76213000E 03	0.12537804E 05
BODY	6	0.11193957E 01	0.76211000E 03	0.10282034E 05
BODY	7	0.88621226E 00	0.76212000E 03	0.11447877E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.91474140E 04	0.42281340E 05	0.49769180E 00
BODY	2	0.11687544E 05	0.51428316E 05	0.40917296E 00
BODY	3	0.19004814E 05	0.63115422E 05	0.33340624E 00
BODY	4	0.18863675E 05	0.82119612E 05	0.25624909E 00
BODY	5	0.14574497E 05	0.10098343E 06	0.20838147E 00
BODY	6	0.15773751E 05	0.59757333E 05	0.17607107E 00
BODY	7	0.19730434E 05	0.55801181E 05	0.18855404E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.15000000E 03	0.12986094E 03	0.13141991E 03
BODY	2	0.15000000E 03	0.11461410E 03	0.12986094E 03
BODY	3	0.12423945E 03	0.10031804E 03	0.11461410E 03
BODY	4	0.11031421E 03	0.86192524E 02	0.10031804E 03
BODY	5	0.97354222E 02	0.63333882E 02	0.86192524E 02
BODY	6	0.84053638E 02	0.71110000E 02	0.72001120E 02
BODY	7	0.70417683E 02	0.71110000E 02	0.53467911E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.18580088E 02	0.71804608E 01	0.27529578E 04
BODY	2	0.20139063E 02	0.56214863E 01	0.27174994E 04
BODY	3	0.96253476E 01	0.42998949E 01	0.26958276E 04
BODY	4	0.99961661E 01	0.29638181E 01	0.26746188E 04
BODY	5	0.11161698E 02	0.21388861E 01	0.26524243E 04
BODY	6	0.12052517E 02	0.15834368E 01	0.26287498E 04
BODY	7	0.16949772E 02	0.17979143E 01	0.25958741E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.56396684E 03	0.57963532E 03	0.63185042E 03
BODY	2	0.46868374E 03	0.56396684E 03	0.63185042E 03
BODY	3	0.39609211E 03	0.46868374E 03	0.52151491E 03
BODY	4	0.33273205E 03	0.39609211E 03	0.46243126E 03
BODY	5	0.23470413E 03	0.33273205E 03	0.40770054E 03
BODY	6	0.27523159E 03	0.27341837E 03	0.35172230E 03
BODY	7	0.27523159E 03	0.19324516E 03	0.29452888E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467873E 05	0.18134161E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.24293965E 05	0.10062566E 04
CONDENSATE FLASH TANK 2	0.23583088E 05	0.71087626E 03

```
FINAL PRODUCT FLOW RATE =            40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =          10089.82 KGS/HR
STEAM REQUIRED IN BODY(2) =          15210.40 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     25300.22 KGS/HR
STEAM ECONOMY =              4.3713 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 102

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5  10  8  8
DESIGN =  0.00                          FCHEAT = 1.00
STEAM TEMP. =  135.56                   FEED TEMP. = 100.00
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  1
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                               75531.50
FEED STREAM  2                               75531.50
MULTIPLE FEED STREAM TO BODY  1                 0.00
MULTIPLE FEED STREAM TO BODY  2                 0.00
MULTIPLE FEED STREAM TO BODY  3                 0.00
MULTIPLE FEED STREAM TO BODY  4                 0.00
MULTIPLE FEED STREAM TO BODY  5                 0.00
MULTIPLE FEED STREAM TO BODY  6                 0.00
MULTIPLE FEED STREAM TO BODY  7                 0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.94613388E 00	0.38111000E 03	0.49844269E 04
BODY 2	0.13158591E 01	0.38107000E 03	0.76328862E 04
BODY 3	0.21315225E 01	0.76216000E 03	0.11745021E 05
BODY 4	0.20988224E 01	0.76214000E 03	0.11986500E 05
BODY 5	0.17181807E 01	0.76213000E 03	0.11069651E 05
BODY 6	0.13049157E 01	0.76211000E 03	0.91943803E 04
BODY 7	0.10330566E 01	0.76212000E 03	0.12757640E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.78623936E 04	0.41903243E 05	0.50218251E 00
BODY 2	0.10402403E 05	0.49764751E 05	0.42285102E 00
BODY 3	0.16761101E 05	0.60166269E 05	0.34974872E 00
BODY 4	0.16718462E 05	0.76927030E 05	0.27354593E 00
BODY 5	0.13261304E 05	0.93645530E 05	0.22470988E 00
BODY 6	0.18336467E 05	0.57194196E 05	0.18396164E 00
BODY 7	0.25817749E 05	0.49713251E 05	0.21164453E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.12033790E 03	0.12173668E 03
BODY 2	0.13556000E 03	0.10724698E 03	0.12033790E 03
BODY 3	0.11447664E 03	0.95169456E 02	0.10724698E 03
BODY 4	0.10266291E 03	0.83453370E 02	0.95169456E 02
BODY 5	0.91906860E 02	0.63870748E 02	0.83453370E 02
BODY 6	0.81033380E 02	0.10000000E 03	0.71788052E 02
BODY 7	0.70069058E 02	0.10000000E 03	0.53865036E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.13823318E 02	0.72600380E 01	0.27347415E 04
BODY	2	0.15222103E 02	0.58612533E 01	0.27036494E 04
BODY	3	0.72296578E 01	0.45840760E 01	0.26845104E 04
BODY	4	0.74934526E 01	0.32625945E 01	0.26663601E 04
BODY	5	0.84534900E 01	0.24199892E 01	0.26476977E 04
BODY	6	0.92453287E 01	0.17189930E 01	0.26282882E 04
BODY	7	0.16204023E 02	0.21950389E 01	0.25962897E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.50186703E 03	0.51112062E 03	0.56980873E 03
BODY	2	0.42584241E 03	0.50186703E 03	0.56980873E 03
BODY	3	0.36831989E 03	0.42584241E 03	0.48006070E 03
BODY	4	0.31779374E 03	0.36831989E 03	0.43008196E 03
BODY	5	0.23404478E 03	0.31779374E 03	0.38474772E 03
BODY	6	0.40524623E 03	0.27127084E 03	0.33903933E 03
BODY	7	0.40524623E 03	0.19121689E 03	0.29306871E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467618E 05	0.14356658E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.21065806E 05	0.64050734E 03
CONDENSATE FLASH TANK 2	0.20542953E 05	0.52285352E 03

```
FINAL PRODUCT FLOW RATE =              40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =      110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =             8574.35 KGS/HR
STEAM REQUIRED IN BODY(2) =            13131.96 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =       21706.31 KGS/HR
STEAM ECONOMY =              5.0951 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 6
```

PLANT NO. 103

NUMBER OF EFFECTS 6		NUMBER OF BODIES 7

FLOW ORDER   7 6 5 4 3 2 1
IFEED ARRAY 2 3 4 5 10 8 8
DESIGN = 0.00   FCHEAT = 1.00
STEAM TEMP. = 135.56   FEED TEMP. =   71.11
CONDENSATE TEMP. =   57.00   RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM = 1
LIQUOR FLASH TANK 1   CONDENSATE FLASH TANK 2
INTEGRAL HEATER 0   FINISHER EFFECT 0
IBLEED 0   KALBPR 1
TOTAL FEED FLOW RATE =   151063.00
MASS FRACTION FEED = 0.139   MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS 2   IFSORD ARRAY 7 6
FEED STREAM 1   75531.50
FEED STREAM 2   75531.50
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00
MULTIPLE FEED STREAM TO BODY 4   0.00
MULTIPLE FEED STREAM TO BODY 5   0.00
MULTIPLE FEED STREAM TO BODY 6   0.00
MULTIPLE FEED STREAM TO BODY 7   0.00

	H T COEFF	AREA	H T RATE
BODY 1	0.10777292E 01	0.38111000E 03	0.54952245E 04
BODY 2	0.14988700E 01	0.38107000E 03	0.85101930E 04
BODY 3	0.24279752E 01	0.76216000E 03	0.13156066E 05
BODY 4	0.23907353E 01	0.76214000E 03	0.13408165E 05
BODY 5	0.19571677E 01	0.76213000E 03	0.12479800E 05
BODY 6	0.14864279E 01	0.76211000E 03	0.10638547E 05
BODY 7	0.11767548E 01	0.76212000E 03	0.11461070E 05
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.86758180E 04	0.41868646E 05	0.50259747E 00
BODY 2	0.11821047E 05	0.50543611E 05	0.41633503E 00
BODY 3	0.19001814E 05	0.62363805E 05	0.33742450E 00
BODY 4	0.18911060E 05	0.81365404E 05	0.25862436E 00
BODY 5	0.15444922E 05	0.10027652E 06	0.20985047E 00
BODY 6	0.16183330E 05	0.59347436E 05	0.17728715E 00
BODY 7	0.19156531E 05	0.56374633E 05	0.18663603E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.12066053E 03	0.12218094E 03
BODY 2	0.13556000E 03	0.10780410E 03	0.12066053E 03
BODY 3	0.11491355E 03	0.96075644E 02	0.10780410E 03
BODY 4	0.10343438E 03	0.84704189E 02	0.96075644E 02
BODY 5	0.93070819E 02	0.66307971E 02	0.84704189E 02
BODY 6	0.82540025E 02	0.71110000E 02	0.73148830E 02
BODY 7	0.71544505E 02	0.71110000E 02	0.58764947E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.13379055E 02	0.72673939E 01	0.27347492E 04
BODY	2	0.14899465E 02	0.57469842E 01	0.27041735E 04
BODY	3	0.71094444E 01	0.43697269E 01	0.26854702E 04
BODY	4	0.73587339E 01	0.30048240E 01	0.26679421E 04
BODY	5	0.83666293E 01	0.21641641E 01	0.26499419E 04
BODY	6	0.93911938E 01	0.16043248E 01	0.26307181E 04
BODY	7	0.12779558E 02	0.17649506E 01	0.26053621F 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.50395530E 03	0.51418772E 03	0.56980873E 03
BODY	2	0.42975548E 03	0.50395530E 03	0.56980873E 03
BODY	3	0.37444969E 03	0.42975548E 03	0.48191259E 03
BODY	4	0.32561586E 03	0.37444969E 03	0.43334076E 03
BODY	5	0.24759736E 03	0.32561586E 03	0.38964887E 03
BODY	6	0.27523159E 03	0.27825395E 03	0.34536500E 03
BODY	7	0.27523159E 03	0.21532416E 03	0.29924901E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467663E 05	0.14010235E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23398152E 05	0.69622324E 03
CONDENSATE FLASH TANK 2	0.22827371E 05	0.57078124E 03

```
FINAL PRODUCT FLOW RATE =           40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =          9453.01 KGS/HR
STEAM REQUIRED IN BODY(2) =         14641.36 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    24094.38 KGS/HR
STEAM ECONOMY =            4.5901 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 104

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER   7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN =  0.00                          FCHEAT =  1.00
STEAM TEMP. = 135.56                    FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  1
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =       151053.00
MASS FRACTION FEED = 0.170              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                               75531.50
FEED STREAM  2                               75531.50
MULTIPLE FEED STREAM TO BODY  1                  0.00
MULTIPLE FEED STREAM TO BODY  2                  0.00
MULTIPLE FEED STREAM TO BODY  3                  0.00
MULTIPLE FEED STREAM TO BODY  4                  0.00
MULTIPLE FEED STREAM TO BODY  5                  0.00
MULTIPLE FEED STREAM TO BODY  6                  0.00
MULTIPLE FEED STREAM TO BODY  7                  0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.96083121E 00	0.38111000E 03	0.53216185E 04
BODY	2	0.13364306E 01	0.38107000E 03	0.80351550E 04
BODY	3	0.21648438E 01	0.76216000E 03	0.12257013E 05
BODY	4	0.21317066E 01	0.76214000E 03	0.12536070E 05
BODY	5	0.17450987E 01	0.76213000E 03	0.11431621E 05
BODY	6	0.13253872E 01	0.76211000E 03	0.94174600E 04
BODY	7	0.10492740E 01	0.76212000E 03	0.10539940E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.83829827E 04	0.51196953E 05	0.50160621E 00
BODY	2	0.10620007E 05	0.59579628E 05	0.43103173E 00
BODY	3	0.17154188E 05	0.70199327E 05	0.36582559E 00
BODY	4	0.17178917E 05	0.87353298E 05	0.29398673E 00
BODY	5	0.13481666E 05	0.10453229E 06	0.24567250E 00
BODY	6	0.14757946E 05	0.60773295E 05	0.21128285E 00
BODY	7	0.18290486E 05	0.57240964E 05	0.22432108E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11978232E 03	0.12102730E 03
BODY	2	0.13556000E 03	0.10634879E 03	0.11978232E 03
BODY	3	0.11377748E 03	0.93768575E 02	0.10634879E 03
BODY	4	0.10148470E 03	0.81557114E 02	0.93768575E 02
BODY	5	0.90152369E 02	0.62239798E 02	0.81557114E 02
BODY	6	0.78775801E 02	0.71110000E 02	0.69452421E 02
BODY	7	0.67263607E 02	0.71110000E 02	0.54083299E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14532699E 02	0.72498230E 01	0.27347308E 04
BODY	2	0.15777680E 02	0.60048425E 01	0.27027673E 04
BODY	3	0.74295849E 01	0.48640914E 01	0.26829394E 04
BODY	4	0.77161244E 01	0.35162050E 01	0.26639190E 04
BODY	5	0.85952550E 01	0.27813129E 01	0.26442856E 04
BODY	6	0.93233794E 01	0.21889141E 01	0.26239040E 04
BODY	7	0.13180319E 02	0.24132924E 01	0.25965132E 04
		ENTHALPY LIN	ENTHALPY LJT	ENTHALPY C
BODY	1	0.49825070E 03	0.50624532E 03	0.56980873E 03
BODY	2	0.41969685E 03	0.49825070E 03	0.56980873E 03
BODY	3	0.35901755E 03	0.41969685E 03	0.47709778E 03
BODY	4	0.30607583E 03	0.35901756E 03	0.42510617E 03
BODY	5	0.22446730E 03	0.30607583E 03	0.37736318E 03
BODY	6	0.27047457E 03	0.25683614E 03	0.32956506E 03
BODY	7	0.27047457E 03	0.19010099E 03	0.28132173E 03

NLORD ARRAY = 4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.49386151E 05	0.18108254E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

VCORD ARRAY = 3 4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.22275989E 05	0.70222630E 03
CONDENSATE FLASH TANK	2	0.21709342E 05	0.56664537E 03

```
FINAL PRODUCT FLOW RATE =            49385.98 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    101677.02 KGS/HR
STEAM REQUIRED IN BODY(1) =           9154.85 KGS/HR
STEAM REQUIRED IN BODY(2) =          13823.37 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     22978.21 KGS/HR
STEAM ECONOMY =                4.4249 KG VAPOR/KG STEAM
NUMBER OF ITERATIONS = 6
```

PLANT NO. 105

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER   7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  3  3
DESIGN =  0.00                          FCHEAT = 1.00
STEAM TEMP. =  135.56                   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67              RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  1
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =        151053.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.550
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                                75531.50
FEED STREAM  2                                75531.50
MULTIPLE FEED STREAM TO BODY  1                0.00
MULTIPLE FEED STREAM TO BODY  2                0.00
MULTIPLE FEED STREAM TO BODY  3                0.00
MULTIPLE FEED STREAM TO BODY  4                0.00
MULTIPLE FEED STREAM TO BODY  5                0.00
MULTIPLE FEED STREAM TO BODY  6                0.00
MULTIPLE FEED STREAM TO BODY  7                0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.10189582E 01	0.38111000E 03	0.55255657E 04
BODY	2	0.14173077E 01	0.38107000E 03	0.85949872E 04
BODY	3	0.22957107E 01	0.76216000E 03	0.13268452E 05
BODY	4	0.22605277E 01	0.76214000E 03	0.13543203E 05
BODY	5	0.18505893E 01	0.76213000E 03	0.12606049E 05
BODY	6	0.14055156E 01	0.76211000E 03	0.10720045E 05
BODY	7	0.11126958E 01	0.76212000E 03	0.11959036E 05

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.86933260E 04	0.39677939E 05	0.53034700E 00
BODY	2	0.11885639E 05	0.48371260E 05	0.43503252E 00
BODY	3	0.19079733E 05	0.60256894E 05	0.34922271E 00
BODY	4	0.18999117E 05	0.79336733E 05	0.26523749E 00
BODY	5	0.15438362E 05	0.98335861E 05	0.21399188E 00
BODY	6	0.16787264E 05	0.58744155E 05	0.17910783E 00
BODY	7	0.20501250E 05	0.55030107E 05	0.19119603E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11964611E 03	0.12133128E 03
BODY	2	0.13556000E 03	0.10598771E 03	0.11964611E 03
BODY	3	0.11357099E 03	0.93551803E 02	0.10598771E 03
BODY	4	0.10141278E 03	0.81494781E 02	0.93551803E 02
BODY	5	0.90432773E 02	0.61856109E 02	0.81494781E 02
BODY	6	0.79259340E 02	0.71110000E 02	0.69251432E 02
BODY	7	0.67615832E 02	0.71110000E 02	0.53513322E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14229717E 02	0.77602905E 01	0.27352650E 04
BODY	2	0.15913889E 02	0.60751189E 01	0.27025354E 04
BODY	3	0.75832833E 01	0.45749219E 01	0.26825758E 04
BODY	4	0.78609820E 01	0.31190297E 01	0.26638495E 04
BODY	5	0.89379903E 01	0.22354403E 01	0.26445286E 04
BODY	6	0.10007908E 02	0.16356002E 01	0.26239391E 04
BODY	7	0.14102509E 02	0.18433264E 01	0.25959216E 04
		ENTHALPY LIN	ENTHALPY OUT	ENTHALPY C
BODY	1	0.49734303E 03	0.50835793E 03	0.56980873E 03
BODY	2	0.41881539E 03	0.49734303E 03	0.56980873E 03
BODY	3	0.36115575E 03	0.41881539E 03	0.47622287E 03
BODY	4	0.31024480E 03	0.36115575E 03	0.42480251E 03
BODY	5	0.22811492E 03	0.31024480E 03	0.37854312E 03
BODY	6	0.27523159E 03	0.26099718E 03	0.33159389E 03
BODY	7	0.27523159E 03	0.19301340E 03	0.28279626E 03

VLORD ARRAY = 4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.38259792E 05	0.14181678E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.55000000E 00	0.81105951E 01

NCORD ARRAY = 3 4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.23543505E 05	0.74864939E 03
CONDENSATE FLASH TANK	2	0.22934942E 05	0.60856248E 03

```
FINAL PRODUCT FLOW RATE =             38260.14 KGS/HR
TOTAL EVAPORATION IN THE PLANT =     112802.86 KGS/HR
STEAM REQUIRED IN BODY(1) =            9505.75 KGS/HR
STEAM REQUIRED IN BODY(2) =           14786.41 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =      24292.15 KGS/HR
STEAM ECONOMY =              4.6435 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 7
```

PLANT NO. 106

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN =  0.00                          FCHEAT =  1.00
STEAM TEMP. =  135.56                   FEED TEMP. =    71.11
CONDENSATE TEMP. =     51.67            RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  1
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  1
TOTAL FEED FLOW RATE =      140000.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                              70000.00
FEED STREAM  2                              70000.00
MULTIPLE FEED STREAM TO BODY  1             0.00
MULTIPLE FEED STREAM TO BODY  2             0.00
MULTIPLE FEED STREAM TO BODY  3             0.00
MULTIPLE FEED STREAM TO BODY  4             0.00
MULTIPLE FEED STREAM TO BODY  5             0.00
MULTIPLE FEED STREAM TO BODY  6             0.00
MULTIPLE FEED STREAM TO BODY  7             0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.91564477E 00	0.38111000E 03	0.50967783E 04
BODY 2	0.12734883E 01	0.38107000E 03	0.78230429E 04
BODY 3	0.20629056E 01	0.75215000E 03	0.12120151E 05
BODY 4	0.20312745E 01	0.76214000E 03	0.12362668E 05
BODY 5	0.16628874E 01	0.76213000E 03	0.11466451E 05
BODY 6	0.12629332E 01	0.76211000E 03	0.96852752E 04
BODY 7	0.99982564E 00	0.75212000E 03	0.10814513E 05

	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.80303659E 04	0.38856838E 05	0.50189363E 00
BODY 2	0.10764040E 05	0.46886456E 05	0.41594101E 00
BODY 3	0.17374042E 05	0.57649747E 05	0.33828422E 00
BODY 4	0.17279698E 05	0.75023521E 05	0.25994514E 00
BODY 5	0.13932509E 05	0.92303313E 05	0.21128169E 00
BODY 6	0.15169080E 05	0.54831307E 05	0.17783635E 00
BODY 7	0.18594574E 05	0.51405065E 05	0.18968948E 00

	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.13556000E 03	0.11943959E 03	0.12095443E 03
BODY 2	0.13556000E 03	0.10599078E 03	0.11943959E 03
BODY 3	0.11369952E 03	0.93620488E 02	0.10599078E 03
BODY 4	0.10160611E 03	0.81545182E 02	0.93620488E 02
BODY 5	0.90592859E 02	0.61860962E 02	0.81545182E 02
BODY 6	0.79356387E 02	0.71110000E 02	0.69293700E 02
BODY 7	0.67679941E 02	0.71110000E 02	0.53487428E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14605566E 02	0.72549175E 01	0.27347361E 04
BODY	2	0.16120406E 02	0.57400773E 01	0.27023749E 04
BODY	3	0.77087308E 01	0.43846712E 01	0.26826749E 04
BODY	4	0.79856239E 01	0.30276287E 01	0.26640109E 04
BODY	5	0.90476779E 01	0.21887942E 01	0.26446431E 04
BODY	6	0.10062686E 02	0.16137587E 01	0.26240280E 04
BODY	7	0.14192514E 02	0.18174301E 01	0.25958945E 04
		ENTHALPY LIN	ENTHALPY OUT	ENTHALPY C
BODY	1	0.49618182E 03	0.50574567E 03	0.56980873E 03
BODY	2	0.41959806E 03	0.49618182E 03	0.56980873E 03
BODY	3	0.35209068E 03	0.41959806E 03	0.47676744E 03
BODY	4	0.31085708E 03	0.36209068E 03	0.42561886E 03
BODY	5	0.22836256E 03	0.31085708E 03	0.37921681E 03
BODY	6	0.27523159E 03	0.26137896E 03	0.33200110E 03
BODY	7	0.27523159E 03	0.19314557E 03	0.28306456E 03

NLORD ARRAY =   4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.37504098E 05	0.13527449E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY =   3   4   .

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.21533052E 05	0.69362603E 03
CONDENSATE FLASH TANK	2	0.20985038E 05	0.54801354E 03

```
FINAL PRODUCT FLOW RATE =            37503.85 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    102496.15 KGS/HR
STEAM REQUIRED IN BODY(1) =           8767.73 KGS/HR
STEAM REQUIRED IN BODY(2) =          13458.94 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     22226.68 KGS/HR
STEAM ECONOMY =             4.6114 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

PLANT NO. 107

NUMBER OF EFFECTS 6   NUMBER OF BODIES 7
FLOW ORDER   7 6 5 4 3 2 1
IFEED ARRAY 2 3 4 5 10 8 8
DESIGN = 0.00   FCHEAT = 1.00
STEAM TEMP. = 135.56   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67   RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM = 1
LIQUOR FLASH TANK 1   CONDENSATE FLASH TANK 2
INTEGRAL HEATER 0   FINISHER EFFECT 0
IBLEED 0   KALBPR 1
TOTAL FEED FLOW RATE =   151063.00
MASS FRACTION FEED = 0.139   MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS 2   IESUPD ARRAY 7 6
FEED STREAM 1   67978.35
FEED STREAM 2   83084.65
MULTIPLE FEED STREAM TO BODY   1   0.00
MULTIPLE FEED STREAM TO BODY   2   0.00
MULTIPLE FEED STREAM TO BODY   3   0.00
MULTIPLE FEED STREAM TO BODY   4   0.00
MULTIPLE FEED STREAM TO BODY   5   0.00
MULTIPLE FEED STREAM TO BODY   6   0.00
MULTIPLE FEED STREAM TO BODY   7   0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.99024250E 00	0.38111000E 03	0.54829244E 04
BODY	2	0.13772364E 01	0.38107000E 03	0.84181282E 04
BODY	3	0.22309704E 01	0.76216000E 03	0.13038403E 05
BODY	4	0.21967626E 01	0.76214000E 03	0.13299016E 05
BODY	5	0.17933627E 01	0.76213000E 03	0.12335216E 05
BODY	6	0.13658264E 01	0.76211000E 03	0.10535081E 05
BODY	7	0.10812806E 01	0.76212000E 03	0.11754621E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.86298340E 04	0.41924147E 05	0.50193211E 00
BODY	2	0.11584355E 05	0.50563160E 05	0.41617406E 00
BODY	3	0.18694038E 05	0.62146694E 05	0.33860330E 00
BODY	4	0.18594611E 05	0.80940436E 05	0.26030384E 00
BODY	5	0.15176055E 05	0.99435146E 05	0.21162613E 00
BODY	6	0.16504110E 05	0.66579849E 05	0.17383175E 00
BODY	7	0.19946131E 05	0.48031925E 05	0.19714771E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11952008E 03	0.12103151E 03
BODY	2	0.13556000E 03	0.10610797E 03	0.11952008E 03
BODY	3	0.11377591E 03	0.93774340E 02	0.10610787E 03
BODY	4	0.10171765E 03	0.81740560E 02	0.93774340E 02
BODY	5	0.90740517E 02	0.63264374E 02	0.81740560E 02
BODY	6	0.79545838E 02	0.71110000E 02	0.69424807E 02
BODY	7	0.67879830E 02	0.71110000E 02	0.53615649E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14528486E 02	0.72555996E 01	0.27347368E 04
BODY	2	0.16039923E 02	0.57441624F 01	0.27024921E 04
BODY	3	0.76680417F 01	0.43902180E 01	0.26828526E 04
BODY	4	0.79433120E 01	0.30334225E 01	0.26642544E 04
BODY	5	0.89999565E 01	0.21947221F 01	0.26449679E 04
BODY	6	0.10121031E 02	0.15449762E 01	0.26243041E 04
BODY	7	0.14264182F 02	0.19456519E 01	0.25960287E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.49669064E 03	0.50627398E 03	0.56980873E 03
BODY	2	0.42022530E 03	0.49669064E 03	0.56980873E 03
BODY	3	0.36281228F 03	0.42022530E 03	0.47709115E 03
BODY	4	0.31170420E 03	0.36291228E 03	0.42608987E 03
BODY	5	0.23020238E 03	0.31170420E 03	0.37983823E 03
BODY	6	0.27523159E 03	0.26257231F 03	0.33279607E 03
BODY	7	0.27523159E 03	0.19249100E 03	0.28390150E 03

VLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467739E 05	0.14564111E 04

	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762718E 01

VCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23172082E 05	0.74266859E 03
CONDENSATE FLASH TANK 2	0.22583858E 05	0.58822381E 03

```
FINAL PRODUCT FLOW RATE =            40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =           9431.99 KGS/HR
STEAM REQUIRED IN BODY(2) =          14482.76 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     23914.75 KGS/HR
STEAM ECONOMY =             4.6246 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 108

```
NUMBER OF EFFECTS  6                      NUMBER OF BODIES   7
FLOW ORDER   7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5  10  8  8
DESIGN =  0.00                            FCHEAT  =  1.00
STEAM TEMP. = 135.56                      FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67                RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  1
LIQUOR FLASH TANK  1                      CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0                        FINISHER EFFECT  0
IBLEED  0                                 KALBPR  1
TOTAL FEED FLOW RATE =          151063.00
MASS FRACTION FEED = 0.139                MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2                 IFSORD ARRAY  7  6
FEED STREAM   1                                 83084.65
FEED STREAM   2                                 67978.35
MULTIPLE FEED STREAM TO BODY  1                     0.00
MULTIPLE FEED STREAM TO BODY  2                     0.00
MULTIPLE FEED STREAM TO BODY  3                     0.00
MULTIPLE FEED STREAM TO BODY  4                     0.00
MULTIPLE FEED STREAM TO BODY  5                     0.00
MULTIPLE FEED STREAM TO BODY  6                     0.00
MULTIPLE FEED STREAM TO BODY  7                     0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.98652401E 00	0.38111000E 03	0.55162120E 04
BODY	2	0.13720709E 01	0.38107000E 03	0.84650744E 04
BODY	3	0.22225935E 01	0.76216000E 03	0.13118364E 05
BODY	4	0.21885131E 01	0.76214000E 03	0.13381010E 05
BODY	5	0.17916102E 01	0.76213000E 03	0.12411060E 05
BODY	6	0.13606939E 01	0.76211000E 03	0.10367248E 05
BODY	7	0.10772220E 01	0.76212000E 03	0.11580992E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.86903018E 04	0.41930053E 05	0.50186142E 00
BODY	2	0.11646915E 05	0.50619562E 05	0.41571035E 00
BODY	3	0.18802486E 05	0.62265684E 05	0.33795623E 00
BODY	4	0.18698381E 05	0.81067891E 05	0.25957349E 00
BODY	5	0.14893629E 05	0.99766373E 05	0.21092353E 00
BODY	6	0.16223622E 05	0.51754094E 05	0.18296879E 00
BODY	7	0.20177856E 05	0.62906524E 05	0.18398237E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11936990E 03	0.12088821E 03
BODY	2	0.13556000E 03	0.10588972E 03	0.11936990E 03
BODY	3	0.11363387E 03	0.93488339E 02	0.10588972E 03
BODY	4	0.10151075E 03	0.81377704E 02	0.93488339E 02
BODY	5	0.90467127E 02	0.60559604E 02	0.81377704E 02
BODY	6	0.79195073E 02	0.71110000E 02	0.69197712E 02
BODY	7	0.67495778E 02	0.71110000E 02	0.53389345E 02

		TEMP DIFF		BPRISE		ENTHALPY V	
BODY	1	0.14671785E	02	0.72543465E	01	0.27347355E	04
BODY	2	0.16190098E	02	0.57360340E	01	0.27022735E	04
BODY	3	0.77441452E	01	0.43789697E	01	0.26825219E	04
BODY	4	0.80224127E	01	0.30212115E	01	0.26639023E	04
BODY	5	0.90894224E	01	0.21826304E	01	0.26443652E	04
BODY	6	0.99973609E	01	0.17019332E	01	0.26237993E	04
BODY	7	0.14106433E	02	0.17193493E	01	0.25957918E	04
		ENTHALPY LIN		ENTHALPY LOUT		ENTHALPY C	
BODY	1	0.49574183E	03	0.50529203E	03	0.56980873E	03
BODY	2	0.41906093E	03	0.49574183E	03	0.56980873E	03
BODY	3	0.36147872E	03	0.41906093E	03	0.47648928E	03
BODY	4	0.31014057E	03	0.36147872E	03	0.42521618E	03
BODY	5	0.22366845E	03	0.31014057E	03	0.37868769E	03
BODY	6	0.27523159E	03	0.26016044E	03	0.33132422E	03
BODY	7	0.27523159E	03	0.19364598E	03	0.28229367E	03

NLORD ARRAY = 4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.40467705E 05	0.14623547E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 3 4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.23298990E 05	0.75377942E 03
CONDENSATE FLASH TANK	2	0.22704739E 05	0.59425025E 03

```
FINAL PRODUCT FLOW RATE =              40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =      110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =             9489.28 KGS/HR
STEAM REQUIRED IN BODY(2) =            14563.49 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =       24052.77 KGS/HR
STEAM ECONOMY =                 4.5980 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 109

NUMBER OF EFFECTS 5   NUMBER OF BODIES 6
FLOW ORDER   6 5 4 3 2 1
IFEED ARRAY 2 3 4 9 7 7
DESIGN = 0.00   FCHEAT = 1.00
STEAM TEMP. = 135.56   FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67   RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM = 1
LIQUOR FLASH TANK 1   CONDENSATE FLASH TANK 2
INTEGRAL HEATER 0   FINISHER EFFECT 0
IBLEED 0   KALBPR 1
TOTAL FEED FLOW RATE =   151063.00
MASS FRACTION FEED = 0.139   MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS 2   IFSORD ARRAY 6 5
FEED STREAM 1   75531.50
FEED STREAM 2   75531.50
MULTIPLE FEED STREAM TO BODY 1   0.00
MULTIPLE FEED STREAM TO BODY 2   0.00
MULTIPLE FEED STREAM TO BODY 3   0.00
MULTIPLE FEED STREAM TO BODY 4   0.00
MULTIPLE FEED STREAM TO BODY 5   0.00
MULTIPLE FEED STREAM TO BODY 6   0.00

		H T COEFF	AREA	H T RATE
BODY	1	0.10122547E 01	0.38111000E 03	0.64184666E 04
BODY	2	0.14079718E 01	0.38107000E 03	0.98423788E 04
BODY	3	0.22457051E 01	0.76214000E 03	0.15405629E 05
BODY	4	0.18384153E 01	0.76213000E 03	0.15511300E 05
BODY	5	0.13962750E 01	0.76211000E 03	0.13189237E 05
BODY	6	0.11053784E 01	0.76212000E 03	0.14236137E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.10081377E 05	0.42015694E 05	0.50083846E 00
BODY	2	0.13627586E 05	0.52097014E 05	0.40392095E 00
BODY	3	0.21765248E 05	0.65724544E 05	0.32017074E 00
BODY	4	0.19422234E 05	0.87489924E 05	0.24051999E 00
BODY	5	0.20216059E 05	0.55315343E 05	0.19021012E 00
BODY	6	0.23934477E 05	0.51596851E 05	0.20391821E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11721569E 03	0.11892238E 03
BODY	2	0.13556000E 03	0.10268514E 03	0.11721569E 03
BODY	3	0.11168617E 03	0.87544362E 02	0.10268514E 03
BODY	4	0.98615073E 02	0.63734678E 02	0.87544362E 02
BODY	5	0.84851909E 02	0.71110000E 02	0.72457351E 02
BODY	6	0.70630971E 02	0.71110000E 02	0.53732094E 02
		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.16637617E 02	0.72362156E 01	0.27347165E 04
BODY	2	0.18344309E 02	0.55295242E 01	0.26991649E 04
BODY	3	0.90010245E 01	0.40700669E 01	0.26777251E 04
BODY	4	0.11070711E 02	0.26924533E 01	0.26543207E 04
BODY	5	0.12394558E 02	0.18263792E 01	0.26293730E 04
BODY	6	0.16898877E 02	0.20620974E 01	0.25961506E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.48240293E 03	0.49192390E 03	0.56980873E 03
BODY	2	0.40292847E 03	0.48240293E 03	0.56980873E 03
BODY	3	0.33493448E 03	0.40292847E 03	0.46823937E 03
BODY	4	0.23398257E 03	0.33493448E 03	0.41301894E 03
BODY	5	0.27523159E 03	0.27323972E 03	0.35507608E 03
BODY	6	0.27523159E 03	0.19189624E 03	0.29542224E 03

NLORD ARRAY = 4

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.40467154E 05	0.15485629E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762718E 01

NCORD ARRAY = 3 4

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.26984041E 05	0.99013770E 03
CONDENSATE FLASH TANK	2	0.26245680E 05	0.73836122E 03

```
FINAL PRODUCT FLOW RATE =           40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =         11041.83 KGS/HR
STEAM REQUIRED IN BODY(2) =         16932.35 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    27974.18 KGS/HR
STEAM ECONOMY =             3.9535 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 7
```

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    6  7  5  4  2  1  3
IFEED ARRAY  2  4  1  5  7  8  6
DESIGN =  0.00                         FCHEAT =  1.00
STEAM TEMP. =  145.00                  FEED TEMP. =   71.20
CONDENSATE TEMP. =   54.50             RADIATION LOSS FRACTION=  0.040
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  1
LIQUOR FLASH TANK  1                   CONDENSATE FLASH TANK   2
INTEGRAL HEATER  4                     FINISHER EFFECT  0
IBLEED  0                              KALBPR  0
TOTAL FEED FLOW RATE =          69000.00
MASS FRACTION FEED = 0.150             MASS FRACTION PRODUCT = 0.500
NUMBER OF FEED STREAMS  1              IFSORD ARRAY  6
FEED STREAM  1                             35000.00
MULTIPLE FEED STREAM TO BODY  1             0.00
MULTIPLE FEED STREAM TO BODY  2             0.00
MULTIPLE FEED STREAM TO BODY  3             0.00
MULTIPLE FEED STREAM TO BODY  4             0.00
MULTIPLE FEED STREAM TO BODY  5             0.00
MULTIPLE FEED STREAM TO BODY  6             0.00
MULTIPLE FEED STREAM TO BODY  7         34000.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.12427624E 01	0.17040000E 03	0.26224245E 04
BODY 2	0.12429040E 01	0.17040000E 03	0.28345142E 04
BODY 3	0.11282051E 01	0.34080000E 03	0.47077008E 04
BODY 4	0.14311271E 01	0.34080000E 03	0.53851428E 04
BODY 5	0.15407653E 01	0.34080000E 03	0.49169236E 04
BODY 6	0.17759293E 01	0.34080000E 03	0.56172523E 04
BODY 7	0.11282161E 01	0.34080000E 03	0.56467972E 04
	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.42170484E 04	0.30580969E 05	0.33844579E 00
BODY 2	0.32482486E 04	0.34797840E 05	0.29743226E 00
BODY 3	0.83869204E 04	0.22193988E 05	0.46634252E 00
BODY 4	0.67642169E 04	0.38045911E 05	0.27203975E 00
BODY 5	0.67442697E 04	0.44810614E 05	0.23097206E 00
BODY 6	0.80715281E 04	0.26928458E 05	0.19496104E 00
BODY 7	0.93734097E 04	0.51555122E 05	0.20075600E 00
	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.14500000E 03	0.13161644E 03	0.13261645E 03
BODY 2	0.14500000E 03	0.12392600E 03	0.13161644E 03
BODY 3	0.12811645E 03	0.13261645E 03	0.11587251E 03
BODY 4	0.10937251E 03	0.85467311E 02	0.98331224E 02
BODY 5	0.94831225E 02	0.79623644E 02	0.85467311E 02
BODY 6	0.82467311E 02	0.71200000E 02	0.73186227E 02
BODY 7	0.71186227E 02	0.73186227E 02	0.56499997E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.12383554E 02	0.45000000E 01	0.27440233E 04
BODY	2	0.13383554E 02	0.35000000E 01	0.27207026E 04
BODY	3	0.12243940E 02	0.65000000E 01	0.26967173E 04
BODY	4	0.11041280E 02	0.35000000E 01	0.26712404E 04
BODY	5	0.93639133E 01	0.30000000E 01	0.26506959E 04
BODY	6	0.92810832E 01	0.20000000E 01	0.26305140E 04
BODY	7	0.14686230E 02	0.20000000E 01	0.26011500E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.56906108E 03	0.57784781E 03	0.61030538E 03
BODY	2	0.48455571E 03	0.56906108E 03	0.61030538E 03
BODY	3	0.57784781E 03	0.47243814E 03	0.53802440E 03
BODY	4	0.32635548E 03	0.38447908E 03	0.45844605E 03
BODY	5	0.28708111E 03	0.32635548E 03	0.39706484E 03
BODY	6	0.27396320E 03	0.27571634E 03	0.34505965E 03
BODY	7	0.27571634E 03	0.20370936E 03	0.29774812E 03

IPROCH = 1

IIH ARRAY = 0 0 1 1 0 1 1

SPECIFIED TEMP. DIFF. RATIO= 0.800

				H T COEFF	AREA
INTEGRAL	HEATER	1	IN BODY	3	0.31032184E 02	0.10800000E 01
INTEGRAL	HEATER	2	IN BODY	4	0.40216552E 02	0.13700000E 01
INTEGRAL	HEATER	3	IN BODY	6	0.22102014E 02	0.17000000E 01
INTEGRAL	HEATER	4	IN BODY	7	0.63745105E 02	0.10800000E 01

					TEMP TIHIN	TEMP TIHOUT
INTEGRAL	HEATER	1	IN BODY	3	0.10716425E 03	0.12392600E 03
INTEGRAL	HEATER	2	IN BODY	4	0.98331224E 02	0.10716425E 03
INTEGRAL	HEATER	3	IN BODY	6	0.68248980E 02	0.79623644E 02
INTEGRAL	HEATER	4	IN BODY	7	0.56499997E 02	0.68248980E 02

					TEMP DIFF	H T RATE
INTEGRAL	HEATER	1	IN BODY	3	0.16761757E 02	0.42132470E 03
INTEGRAL	HEATER	2	IN BODY	4	0.88330241E 01	0.36500277E 03
INTEGRAL	HEATER	3	IN BODY	6	0.11374663E 02	0.32053885E 03
INTEGRAL	HEATER	4	IN BODY	7	0.11748983E 02	0.60664157E 03

NLORD ARRAY = 6

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.20700098E 05	0.14943572E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.50000000E 00	0.75000000E 01

NCORD ARRAY = 3 5

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.93574505E 04	0.25429206E 03
CONDENSATE FLASH TANK 2	0.87729435E 04	0.58450706E 03

FINAL PRODUCT FLOW RATE =   20700.00 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   48300.00 KGS/HR
STEAM REQUIRED IN BODY(1) =   .4619.36 KGS/HR
STEAM REQUIRED IN BODY(2) =   4992.38 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   9611.74 KGS/HR
STEAM ECONOMY =   5.0251 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 6

```
NUMBER OF EFFECTS  6              NUMBER OF BODIES  6
FLOW ORDER    6  5  4  3  2  1
IFEED ARRAY  2  3  4  9  7  7
DESIGN =  0.00                   FCHEAT =  1.00
STEAM TEMP. = 135.56             FEED TEMP. =   71.11
CONDENSATE TEMP. =    51.67      RADIATION LOSS FRACTION= 0.030
ISIM =  0
LIQUOR FLASH TANK  1             CONDENSATE FLASH TANK   2
INTEGRAL HEATER  0               FINISHER EFFECT   0
IBLEED  0                        KALBPR  0
TOTAL FEED FLOW RATE =      151063.00
MASS FRACTION FEED = 0.139       MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2        IFSORD ARRAY  6  5
FEED STREAM  1                       75531.50
FEED STREAM  2                       75531.50
MULTIPLE FEED STREAM TO BODY  1       0.00
MULTIPLE FEED STREAM TO BODY  2       0.00
MULTIPLE FEED STREAM TO BODY  3       0.00
MULTIPLE FEED STREAM TO BODY  4       0.00
MULTIPLE FEED STREAM TO BODY  5       0.00
MULTIPLE FEED STREAM TO BODY  6       0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.11805114E 01	0.77185620E 03	0.13888815E 05
BODY	2	0.22259479E 01	0.77181620E 03	0.13017942E 05
BODY	3	0.21918575E 01	0.77183545E 03	0.13316397E 05
BODY	4	0.17943693E 01	0.77184395E 03	0.12361903E 05
BODY	5	0.13628178E 01	0.77183696E 03	0.10460314E 05
BODY	6	0.10788975E 01	0.77184581E 03	0.11682501E 05

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.20319084E 05	0.41904191E 05	0.50217115E 00
BODY	2	0.18666357E 05	0.62223252E 05	0.33818669E 00
BODY	3	0.18629537E 05	0.80889766E 05	0.26014509E 00
BODY	4	0.15058439E 05	0.99519427E 05	0.21144691E 00
BODY	5	0.16401102E 05	0.59130459E 05	0.17793770E 00
BODY	6	0.20084228E 05	0.55447424E 05	0.18975702E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.10548030E 03	0.12031741E 03
BODY	2	0.11305758E 03	0.93225974E 02	0.10548030E 03
BODY	3	0.10109733E 03	0.81269154E 02	0.93225974E 02
BODY	4	0.90194890E 02	0.61774100E 02	0.81269154E 02
BODY	5	0.79077506E 02	0.71110000E 02	0.69133043E 02
BODY	6	0.67517535E 02	0.71110000E 02	0.53488587E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.15242585E 02	0.72598330E 01	0.27030149E 04
BODY	2	0.75772820E 01	0.43829644E 01	0.26818881E 04
BODY	3	0.78713587E 01	0.30310837E 01	0.26633749E 04
BODY	4	0.89257358E 01	0.21916473E 01	0.26441767E 04
BODY	5	0.99444636E 01	0.16155071E 01	0.26237467E 04
BODY	6	0.14028948E 02	0.18185913E 01	0.25958957E 04

		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.41677848E 03	0.50138808E 03	0.56980873E 03
BODY	2	0.36011732E 03	0.41677848E 03	0.47404774E 03
BODY	3	0.30956992E 03	0.36011732E 03	0.42347055E 03
BODY	4	0.22798940E 03	0.30956992E 03	0.37754210E 03
BODY	5	0.27523159E 03	0.26066849E 03	0.33083093E 03
BODY	6	0.27523159E 03	0.19313964E 03	0.28238475E 03

NLORD ARRAY =   3

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.40467453E 05	0.14367994E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.52000000E 00	0.75762717E 01

NCORD ARRAY =   2   3

		PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK	1	0.23187272E 05	0.70616608E 03
CONDENSATE FLASH TANK	2	0.22536591E 05	0.65068123E 03

```
FINAL PRODUCT FLOW RATE =           40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   110595.55 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    23893.44 KGS/HR
STEAM ECONOMY =            4.6287 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   6
```

```
NUMBER OF EFFECTS  6              NUMBER OF BODIES  7
FLOW ORDER   7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN = 0.00                     FCHEAT = 1.00
STEAM TEMP. = 135.56              FEED TEMP. =   71.11
CONDENSATE TEMP. =   51.67        RADIATION LOSS FRACTION= 0.030
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM =  0
LIQUOR FLASH TANK  1              CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                FINISHER EFFECT  0
IBLEED  0                         KALBPR  0
TOTAL FEED FLOW RATE =       151063.00
MASS FRACTION FEED = 0.139        MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2         IFSORD ARRAY  7  6
FEED STREAM  1                       75531.50
FEED STREAM  2                       75531.50
MULTIPLE FEED STREAM TO BODY  1         0.00
MULTIPLE FEED STREAM TO BODY  2         0.00
MULTIPLE FEED STREAM TO BODY  3         0.00
MULTIPLE FEED STREAM TO BODY  4         0.00
MULTIPLE FEED STREAM TO BODY  5         0.00
MULTIPLE FEED STREAM TO BODY  6         0.00
MULTIPLE FEED STREAM TO BODY  7         0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.98805764E 00	0.38111000E 03	0.55003922E 04
BODY	2	0.13741634E 01	0.38107000E 03	0.84423248E 04
BODY	3	0.22262422E 01	0.76216000E 03	0.13079758E 05
BODY	4	0.21921146E 01	0.76214000E 03	0.13340859E 05
BODY	5	0.17940787E 01	0.76213000E 03	0.12373368E 05
BODY	6	0.13630492E 01	0.76211000E 03	0.10451301E 05
BODY	7	0.10787008E 01	0.76212000E 03	0.11666577E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.86661339E 04	0.41925826E 05	0.50191202E 00
BODY	2	0.11616281E 05	0.50590496E 05	0.41594919E 00
BODY	3	0.18755712E 05	0.62205313E 05	0.33828422E 00
BODY	4	0.18647075E 05	0.80960686E 05	0.25991721E 00
BODY	5	0.15034692E 05	0.99607891E 05	0.21125912E 00
BODY	6	0.16363407E 05	0.59168006E 05	0.17782478E 00
BODY	7	0.20056771E 05	0.55474693E 05	0.18966374E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11943800E 03	0.12095300E 03
BODY	2	0.13556000E 03	0.10598930E 03	0.11943800E 03
BODY	3	0.11369800E 03	0.93655396E 02	0.10598930E 03
BODY	4	0.10164060E 03	0.81578445E 02	0.93655396E 02
BODY	5	0.90627796E 02	0.61896090E 02	0.81578445E 02
BODY	6	0.79389644E 02	0.71110000E 02	0.69328644E 02
BODY	7	0.67714864E 02	0.71110000E 02	0.53523663E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.14607000E 02	0.72549000E 01	0.27347361E 04
BODY	2	0.16122000E 02	0.57400000E 01	0.27023726E 04
BODY	3	0.77087000E 01	0.43487000E 01	0.26826904E 04
BODY	4	0.79852000E 01	0.30276000E 01	0.26640670E 04
BODY	5	0.90493500E 01	0.21888000E 01	0.26446991E 04
BODY	6	0.10061000E 02	0.16137800E 01	0.26240887E 04
BODY	7	0.14191200E 02	0.18174400E 01	0.25958945E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.49617162E 03	0.50573581E 03	0.56980873E 03
BODY	2	0.41958982E 03	0.49617162E 03	0.56980873E 03
BODY	3	0.36226659E 03	0.41958982E 03	0.47676101E 03
BODY	4	0.31101265E 03	0.36226659E 03	0.42576448E 03
BODY	5	0.22851354E 03	0.31101265E 03	0.37936384E 03
BODY	6	0.27523159E 03	0.26153190E 03	0.33214066E 03
BODY	7	0.27523159E 03	0.19329695E 03	0.28321086E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40470028E 05	0.14554723E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762717E 01

NCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23234502E 05	0.74850804E 03
CONDENSATE FLASH TANK 2	0.22643198E 05	0.59130434E 03

```
FINAL PRODUCT FLOW RATE =          40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =  110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =         9460.56 KGS/HR
STEAM REQUIRED IN BODY(2) =        14522.45 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   23983.01 KGS/HR
STEAM ECONOMY =            4.6114 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 6
```

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN = 0.00                           FCHEAT = 1.00
STEAM TEMP. = 135.56                    FEED TEMP. =    71.11
CONDENSATE TEMP. =    51.67             RADIATION LOSS FRACTION= 0.03)
AREA RATIO OF BODY(1) TO BODY(2) = 1.000
ISIM = 0
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  2
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IRLEED  0                               KALBPR  0
TOTAL FEED FLOW RATE =        151063.00
MASS FRACTION FEED = 0.139              MASS FRACTION PRODUCT = 0.520
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                               75531.50
FEED STREAM  2                               75531.50
MULTIPLE FEED STREAM TO BODY  1               0.0)
MULTIPLE FEED STREAM TO BODY  2               0.00
MULTIPLE FEED STREAM TO BODY  3               0.00
MULTIPLE FEED STREAM TO BODY  4               0.00
MULTIPLE FEED STREAM TO BODY  5               0.00
MULTIPLE FEED STREAM TO BODY  6               0.00
MULTIPLE FEED STREAM TO BODY  7               0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.98835975E 00	0.38111000E 03	0.55020739E 04
BODY	2	0.13738244E 01	0.38107000E 03	0.84402422E 04
BODY	3	0.22262526E 01	0.76216000E 03	0.13079819E 05
BODY	4	0.21921212E 01	0.76214000E 03	0.13340899E 05
BODY	5	0.17940836E 01	0.76213000E 03	0.12373402E 05
BODY	6	0.13630507E 01	0.76211000E 03	0.10451312E 05
BODY	7	0.10787004E 01	0.76212000E 03	0.11666574E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.86691777E 04	0.41922674E 05	0.50194974E 00
BODY	2	0.11613213E 05	0.50591845E 05	0.41593809E 00
BODY	3	0.18755898E 05	0.62205052E 05	0.33828564E 00
BODY	4	0.18647125E 05	0.80961123E 05	0.25991581E 00
BODY	5	0.15034706E 05	0.99608379E 05	0.21125809E 00
BODY	6	0.16363397E 05	0.59168173E 05	0.17782428E 00
BODY	7	0.20056738E 05	0.55474926E 05	0.18966294E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.13556000E 03	0.11943800E 03	0.12095300E 03
BODY	2	0.13556000E 03	0.10598930E 03	0.11943800E 03
BODY	3	0.11369800E 03	0.93655396E 02	0.10598930E 03
BODY	4	0.10164060E 03	0.81578445E 02	0.93655396E 02
BODY	5	0.90627796E 02	0.61896083E 02	0.81578445E 02
BODY	6	0.79389644E 02	0.71110000E 02	0.69328644E 02
BODY	7	0.67714864E 02	0.71110000E 02	0.53523663E 02

	TEMP DIFF	BPRISE	ENTHALPY V
BODY 1	0.14607000E 02	0.72549000E 01	0.27347361E 04
BODY 2	0.16122000E 02	0.57400000E 01	0.27023726E 04
BODY 3	0.77087000E 01	0.43487000E 01	0.26826904E 04
BODY 4	0.79852000E 01	0.30276000E 01	0.26640670E 04
BODY 5	0.90493500E 01	0.21888000E 01	0.26446991E 04
BODY 6	0.10461000E 02	0.16137800E 01	0.26240887E 04
BODY 7	0.14191200E 02	0.18174400E 01	0.25958945E 04
	ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY 1	0.49617172E 03	0.50573578E 03	0.56980873E 03
BODY 2	0.41958972E 03	0.49617172E 03	0.56980873E 03
BODY 3	0.36226675E 03	0.41958972E 03	0.47676101E 03
BODY 4	0.31101280E 03	0.36226675E 03	0.42576448E 03
BODY 5	0.22851362E 03	0.31101280E 03	0.37936384E 03
BODY 6	0.27523159E 03	0.26153198E 03	0.33214066E 03
BODY 7	0.27523159E 03	0.19329707E 03	0.28321086E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.40467454E 05	0.14552881E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.52000000E 00	0.75762717E 01

NCORD ARRAY = 3 4

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.23236893E 05	0.74858505E 03
CONDENSATE FLASH TANK 2	0.22645528E 05	0.59136518E 03

```
FINAL PRODUCT FLOW RATE =            40467.45 KGS/HR
TOTAL EVAPORATION IN THE PLANT =    110595.55 KGS/HR
STEAM REQUIRED IN BODY(1) =           9465.42 KGS/HR
STEAM REQUIRED IN BODY(2) =          14520.06 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     23985.48 KGS/HR
STEAM ECONOMY =              4.6109 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 204

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    7  6  5  4  3  2  1
IFEED ARRAY  2  3  4  5 10  8  8
DESIGN = 0.00                           FCHEAT = 1.00
STEAM TEMP. = 144.50                    FEED TEMP. =   75.00
CONDENSATE TEMP. =   46.10              RADIATION LOSS FRACTION= 0.035
AREA RATIO OF BODY(1) TO BODY(2) = 0.323
ISIM = 0
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  1
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  0
TOTAL FEED FLOW RATE =       162500.00
MASS FRACTION FEED = 0.165              MASS FRACTION PRODUCT = 0.545
NUMBER OF FEED STREAMS  2               IFSORD ARRAY  7  6
FEED STREAM  1                             81250.00
FEED STREAM  2                             81250.00
MULTIPLE FEED STREAM TO BODY  1                0.00
MULTIPLE FEED STREAM TO BODY  2                0.00
MULTIPLE FEED STREAM TO BODY  3                0.00
MULTIPLE FEED STREAM TO BODY  4                0.00
MULTIPLE FEED STREAM TO BODY  5                0.00
MULTIPLE FEED STREAM TO BODY  6                0.00
MULTIPLE FEED STREAM TO BODY  7                0.00
```

	H T COEFF	AREA	H T RATE
BODY 1	0.12149886E 01	0.15751569E 03	0.31382905E 04
BODY 2	0.14090346E 01	0.48773459E 03	0.11814468E 05
BODY 3	0.14590081E 01	0.64682212E 03	0.13070761E 05
BODY 4	0.16650009E 01	0.81982129E 03	0.13529463E 05
BODY 5	0.14760025E 01	0.81982046E 03	0.12301511E 05
BODY 6	0.11979998E 01	0.81981967E 03	0.10179972E 05
BODY 7	0.10549984E 01	0.81981910E 03	0.12290341E 05

	VAPOR FLOW	PRODUCT	MASS FRACTION
BODY 1	0.49092823E 04	0.52112059E 05	0.51451622E 00
BODY 2	0.15389797E 05	0.57081420E 05	0.46972377E 00
BODY 3	0.17911690E 05	0.72471296E 05	0.36997407E 00
BODY 4	0.18276193E 05	0.90383617E 05	0.29665221E 00
BODY 5	0.14359191E 05	0.10865997E 06	0.24675599E 00
BODY 6	0.17136423E 05	0.64113745E 05	0.20910102E 00
BODY 7	0.22344913E 05	0.58905379E 05	0.22758957E 00

	TEMP C	TEMP TIN	TEMP TOUT
BODY 1	0.14450000E 03	0.12730869E 03	0.12810176E 03
BODY 2	0.14450000E 03	0.10677245E 03	0.12730869E 03
BODY 3	0.12062273E 03	0.91924402E 02	0.10677245E 03
BODY 4	0.10183607E 03	0.78095968E 02	0.91924402E 02
BODY 5	0.88262028E 02	0.57410981E 02	0.78095968E 02
BODY 6	0.75295945E 02	0.75000000E 02	0.64930892E 02
BODY 7	0.62779614E 02	0.75000000E 02	0.48569614E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.16398236E 02	0.74790359E 01	0.27465160E 04
BODY	2	0.17191310E 02	0.66859619E 01	0.27134608E 04
BODY	3	0.13850273E 02	0.49363798E 01	0.26836068E 04
BODY	4	0.99116709E 01	0.36623745E 01	0.26609123E 04
BODY	5	0.10166059E 02	0.28000231E 01	0.26384042E 04
BODY	6	0.10365052E 02	0.21512774E 01	0.26160035E 04
BODY	7	0.14210001E 02	0.24696171E 01	0.25865665E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.54908407E 03	0.55634209E 03	0.60815468E 03
BODY	2	0.42182251E 03	0.54908407E 03	0.60815468E 03
BODY	3	0.34943527E 03	0.42182251E 03	0.50613908E 03
BODY	4	0.28997344E 03	0.34943527E 03	0.42658995E 03
BODY	5	0.20410194E 03	0.28997344E 03	0.36941104E 03
BODY	6	0.28825176E 03	0.23769298E 03	0.31497069E 03
BODY	7	0.28825176E 03	0.16754081E 03	0.26255717E 03

NLORD ARRAY = 4

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.49197250E 05	0.29152613E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.54500000E 00	0.80213748E 01

NCORD ARRAY = 3

	PRODUCT	VAPOR FLOW
CONDENSATE FLASH TANK 1	0.25298250E 05	0.88407703E 03

```
FINAL PRODUCT FLOW RATE =              49197.25 KGS/HR
TOTAL EVAPORATION IN THE PLANT =      113302.75 KGS/HR
STEAM REQUIRED IN BODY(1) =             5495.16 KGS/HR
STEAM REQUIRED IN BODY(2) =            20687.17 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =       26182.33 KGS/HR
STEAM ECONOMY =              4.3275 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  6
```

PLANT NO. 205

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    6  7  5  4  3  2  1
IFEED ARRAY   2  3  4  5  7  8  6
DESIGN =  0.00                          FCHEAT =  1.00
STEAM TEMP. =  136.60                   FEED TEMP. =    81.11
CONDENSATE TEMP. =    51.20             RADIATION LOSS FRACTION= 0.000
AREA RATIO CF BODY(1) TO BODY(2) = 0.639
ISIM = 0
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  0
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  0
TOTAL FEED FLOW RATE =         150000.00
MASS FRACTION FEED = 0.147              MASS FRACTION PRODUCT = 0.531
NUMBER OF FEED STREAMS  1               IFSORD ARRAY  6
FEED STREAM  1                              85700.00
MULTIPLE FEED STREAM TO BODY  1                0.00
MULTIPLE FEED STREAM TO BODY  2                0.00
MULTIPLE FEED STREAM TO BODY  3                0.00
MULTIPLE FEED STREAM TO BODY  4                0.00
MULTIPLE FEED STREAM TO BODY  5            64300.00
MULTIPLE FEED STREAM TO BODY  6                0.00
MULTIPLE FEED STREAM TO BODY  7                0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.10046005E 01	0.26200000E 03	0.41060032E 04
BODY	2	0.12625802E 01	0.41000000E 03	0.93178423E 04
BODY	3	0.25828622E 01	0.67500000E 03	0.12901397E 05
BODY	4	0.17586438E 01	0.67500000E 03	0.11811491E 05
BODY	5	0.17978983E 01	0.67500000E 03	0.10922232E 05
BODY	6	0.28208618E 01	0.67500000E 03	0.10186837E 05
BODY	7	0.15446602E 01	0.67500000E 03	0.12928806E 05
		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.63186661E 04	0.42621114E 05	0.51734921E 00
BODY	2	0.12762318E 05	0.49100000E 05	0.44908350E 00
BODY	3	0.18102909E 05	0.62022538E 05	0.35551592E 00
BODY	4	0.16169047E 05	0.80125462E 05	0.27519342E 00
BODY	5	0.14890392E 05	0.96294511E 05	0.22898501E 00
BODY	6	0.17343979E 05	0.68356031E 05	0.18429829E 00
BODY	7	0.21471145E 05	0.46884896E 05	0.26869847E 00
		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.11300000E 03	0.11860000E 03	0.12100000E 03
BODY	2	0.11300000E 03	0.10450000E 03	0.11860000E 03
BODY	3	0.10120000E 03	0.90950000E 02	0.10450000E 03
BODY	4	0.88800000E 02	0.79100000E 02	0.90950000E 02
BODY	5	0.77400000E 02	0.53300000E 02	0.79100000E 02
BODY	6	0.69250000E 02	0.81110000E 02	0.70550000E 02
BODY	7	0.51199999E 02	0.70550000E 02	0.53300000E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.15600000E 02	0.80000000E 01	0.27037043E 04
BODY	2	0.18000000E 02	0.56000000E 01	0.26833205E 04
BODY	3	0.73999999E 01	0.33000000E 01	0.26614051E 04
BODY	4	0.99500000E 01	0.21500000E 01	0.26413000E 04
BODY	5	0.90000000E 01	0.17000000E 01	0.26268485E 04
BODY	6	0.53500000E 01	0.13000000E 01	0.25945102E 04
BODY	7	0.12400000E 02	0.21000000E 01	0.25953475E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.49043022E 03	0.50604545E 03	0.57425946E 03
BODY	2	0.41005955E 03	0.49043022E 03	0.57425946E 03
BODY	3	0.34713264E 03	0.41005955E 03	0.42390403E 03
BODY	4	0.29714725E 03	0.34713264E 03	0.37167370E 03
BODY	5	0.17994182E 03	0.29714725E 03	0.32379369E 03
BODY	6	0.31795621E 03	0.26582021E 03	0.28963858E 03
BODY	7	0.26582021E 03	0.17994182E 03	0.21414663E 03

NLORD ARRAY = 3

	PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK 1	0.41205007E 05	0.14161170E 04
	MASS FRACTION	BPRLFT
LIQUOR FLASH TANK 1	0.53100000E 00	0.88000000E 01

```
FINAL PRODUCT FLOW RATE =           41525.42 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   108474.58 KGS/HR
STEAM REQUIRED IN BODY(1) =          6861.57 KGS/HR
STEAM REQUIRED IN BODY(2) =         15571.11 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =    22432.69 KGS/HR
STEAM ECONOMY =            4.8356 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =  7
```

PLANT NO. 206

```
NUMBER OF EFFECTS  6                    NUMBER OF BODIES  7
FLOW ORDER    6  7  5  4  3  2  1
IFEED ARRAY   2  3  4  5  7  8  6
DESIGN = 0.00                           FCHEAT = 1.00
STEAM TEMP. = 143.20                    FEED TEMP. =   81.11
CONDENSATE TEMP. =   60.80              RADIATION LOSS FRACTION= 0.000
AREA RATIO OF BODY(1) TO BODY(2) = 0.639
ISIM = 0
LIQUOR FLASH TANK  1                    CONDENSATE FLASH TANK  0
INTEGRAL HEATER  0                      FINISHER EFFECT  0
IBLEED  0                               KALBPR  0
TOTAL FEED FLOW RATE =       138900.00
MASS FRACTION FEED = 0.143              MASS FRACTION PRODUCT = 0.506
NUMBER OF FEED STREAMS  1               IFSORD ARRAY  6
FEED STREAM  1                             81900.00
MULTIPLE FEED STREAM TO BODY  1                0.00
MULTIPLE FEED STREAM TO BODY  2                0.00
MULTIPLE FEED STREAM TO BODY  3                0.00
MULTIPLE FEED STREAM TO BODY  4                0.00
MULTIPLE FEED STREAM TO BODY  5            57000.00
MULTIPLE FEED STREAM TO BODY  6                0.00
MULTIPLE FEED STREAM TO BODY  7                0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.93078309E 00	0.26200000E 03	0.33726553E 04
BODY	2	0.14037548E 01	0.41000000E 03	0.91223004E 04
BODY	3	0.12184345E 01	0.67500000E 03	0.12065243E 05
BODY	4	0.28397094E 01	0.67500000E 03	0.11079126E 05
BODY	5	0.22544228E 01	0.67500000E 03	0.10393453E 05
BODY	6	0.14540901E 01	0.67500000E 03	0.95010244E 04
BODY	7	0.25656921E 01	0.67500000E 03	0.11205019E 05

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.52612118E 04	0.41092629E 05	0.48336406E 00
BODY	2	0.11853512E 05	0.46500000E 05	0.42715484E 00
BODY	3	0.17123533E 05	0.58499672E 05	0.33953524E 00
BODY	4	0.15667896E 05	0.75623232E 05	0.26265341E 00
BODY	5	0.13474908E 05	0.91291147E 05	0.21757531E 00
BODY	6	0.15832691E 05	0.66067328E 05	0.17726916E 00
BODY	7	0.18301306E 05	0.47766052E 05	0.24518878E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.12250000E 03	0.12735000E 03	0.12937000E 03
BODY	2	0.12250000E 03	0.10783000E 03	0.12735000E 03
BODY	3	0.10483000E 03	0.95720001E 02	0.10783000E 03
BODY	4	0.93720000E 02	0.86170000E 02	0.95720001E 02
BODY	5	0.84610000E 02	0.62630000E 02	0.86170000E 02
BODY	6	0.71800000E 02	0.81110000E 02	0.73020001E 02
BODY	7	0.60800000E 02	0.73020001E 02	0.62630000E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.13830000E 02	0.68700000E 01	0.27163389E 04
BODY	2	0.15850000E 02	0.48500000E 01	0.26881081E 04
BODY	3	0.14670000E 02	0.30000000E 01	0.26689652E 04
BODY	4	0.57799999E 01	0.20000000E 01	0.26531972E 04
BODY	5	0.68300000E 01	0.15600000E 01	0.26311122E 04
BODY	6	0.96799999E 01	0.12200000E 01	0.26115344E 04
BODY	7	0.64700000E 01	0.18300000E 01	0.26121729E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.54790846E 03	0.56412218E 03	0.60256600E 03
BODY	2	0.42976834E 03	0.54790846E 03	0.60256600E 03
BODY	3	0.37224520E 03	0.42976834E 03	0.43923763E 03
BODY	4	0.33142024E 03	0.37224520E 03	0.39238318E 03
BODY	5	0.22216491E 03	0.33142024E 03	0.35405968E 03
BODY	6	0.31852191E 03	0.27769183E 03	0.30031940E 03
BODY	7	0.27769183E 03	0.22216491E 03	0.25427666E 03

NLCRD ARRAY = 3

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.38962098E 05	0.21305890E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.50600000E 00	0.76000001E 01

FINAL PRODUCT FLOW RATE =   39254.35 KGS/HR
TOTAL EVAPORATION IN THE PLANT =   99645.65 KGS/HR
STEAM REQUIRED IN BODY(1) =   5688.28 KGS/HR
STEAM REQUIRED IN BODY(2) =   15385.57 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =   21073.86 KGS/HR
STEAM ECONOMY =   4.7284 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS = 7

PLANT NO. 207

```
NUMBER OF EFFECTS   6                    NUMBER OF BODIES   7
FLOW ORDER    6   7   5   4   3   2   1
IFEED ARRAY  2   3   4   5   7   8   6
DESIGN =  0.00                           FCHEAT =  1.00
STEAM TEMP. =  140.90                    FEED TEMP. =   78.33
CONDENSATE TEMP. =   68.12               RADIATION LOSS FRACTION= 0.000
AREA RATIO OF BODY(1) TO BODY(2) = 0.639
ISIM =  0
LIQUOR FLASH TANK  1                     CONDENSATE FLASH TANK  0
INTEGRAL HEATER  0                       FINISHER EFFECT  0
IRLFED  0                                KALBPR  0
TOTAL FEED FLOW RATE =        110300.00
MASS FRACTION FEED = 0.149               MASS FRACTION PRODUCT = 0.480
NUMBER OF FEED STREAMS  1                IFSORD ARRAY  6
FEED STREAM  1                              64800.00
MULTIPLE FEED STREAM TO BODY   1               0.00
MULTIPLE FEED STREAM TO BODY   2               0.00
MULTIPLE FEED STREAM TO BODY   3               0.00
MULTIPLE FEED STREAM TO BODY   4               0.00
MULTIPLE FEED STREAM TO BODY   5           45500.00
MULTIPLE FEED STREAM TO BODY   6               0.00
MULTIPLE FEED STREAM TO BODY   7               0.00
```

		H T COEFF	AREA	H T RATE
BODY	1	0.10543502E 01	0.26200000E 03	0.29309038E 04
BODY	2	0.14411582E 01	0.41000000E 03	0.71554947E 04
BODY	3	0.12947364E 01	0.67500000E 03	0.97969464E 04
BODY	4	0.10013811E 01	0.67500000E 03	0.87533225E 04
BODY	5	0.20423817E 01	0.67500000E 03	0.82027154E 04
BODY	6	0.10556195E 01	0.67500000E 03	0.72465638E 04
BODY	7	0.25782409E 01	0.67500000E 03	0.78314066E 04

		VAPOR FLOW	PRODUCT	MASS FRACTION
BODY	1	0.46479886E 04	0.35555811E 05	0.46222262E 00
BODY	2	0.95769470E 04	0.40300000E 05	0.40780893E 00
BODY	3	0.13438841E 05	0.49973148E 05	0.32887062E 00
BODY	4	0.12470101E 05	0.63412014E 05	0.25917329E 00
BODY	5	0.10342647E 05	0.75882136E 05	0.21658193E 00
BODY	6	0.11353715E 05	0.53446303E 05	0.18065234E 00
BODY	7	0.12721551E 05	0.40724782E 05	0.23708414E 00

		TEMP C	TEMP TIN	TEMP TOUT
BODY	1	0.12440000E 03	0.12879000E 03	0.13029000E 03
BODY	2	0.12440000E 03	0.11279000E 03	0.12879000E 03
BODY	3	0.10990000E 03	0.97250000E 02	0.11279000E 03
BODY	4	0.95250000E 02	0.89050000E 02	0.97250000E 02
BODY	5	0.87500000E 02	0.69899999E 02	0.89050000E 02
BODY	6	0.75610000E 02	0.78330000E 02	0.76830000E 02
BODY	7	0.68120000E 02	0.76830000E 02	0.69899999E 02

		TEMP DIFF	BPRISE	ENTHALPY V
BODY	1	0.10610000E 02	0.58900000E 01	0.27180071E 04
BODY	2	0.12110000E 02	0.43900000E 01	0.26953009E 04
BODY	3	0.11210000E 02	0.28900000E 01	0.26712595E 04
BODY	4	0.12950000E 02	0.20000000E 01	0.26579333E 04
BODY	5	0.59500000E 01	0.15500000E 01	0.26376312E 04
BODY	6	0.10170000E 02	0.12200000E 01	0.26243821E 04
BODY	7	0.45000000E 01	0.17800000E 01	0.26249682E 04
		ENTHALPY LIN	ENTHALPY LOUT	ENTHALPY C
BODY	1	0.55676804E 03	0.56958883E 03	0.59268916E 03
BODY	2	0.45837615E 03	0.55676804E 03	0.59268916E 03
BODY	3	0.38028380E 03	0.45837615E 03	0.46067823E 03
BODY	4	0.34511011E 03	0.38028380E 03	0.39882959E 03
BODY	5	0.25476144E 03	0.34511011E 03	0.36620658E 03
BODY	6	0.30532181E 03	0.29400703E 03	0.31628738E 03
BODY	7	0.29400703E 03	0.25476144E 03	0.28490703E 03

NLORD ARRAY = 3

		PRODUCT	VAPOR FLOW
LIQUOR FLASH TANK	1	0.34046604E 05	0.15092478E 04
		MASS FRACTION	BPRLFT
LIQUOR FLASH TANK	1	0.48000000E 00	0.66100000E 01

```
FINAL PRODUCT FLOW RATE =            34238.96 KGS/HR
TOTAL EVAPORATION IN THE PLANT =     76061.04 KGS/HR
STEAM REQUIRED IN BODY(1) =           4927.20 KGS/HR
STEAM REQUIRED IN BODY(2) =          12029.24 KGS/HR
TOTAL STEAM REQUIRED IN BODIES =     16956.44 KGS/HR
STEAM ECONOMY =              4.4857 KGS VAPOR/KG STEAM
NUMBER OF ITERATIONS =   7
```